

NAVY
Proposal Submission

The responsibility for the implementation, administration and management of the Navy SBIR program is with the Office of the Chief of Naval Research. The Navy SBIR program manager is Dr. Carl E. Mueller. Inquiries of a general nature may be brought to the Navy SBIR program manager's attention and should be addressed to:

Office of the Chief of Naval Research
Attn: Dr. Carl E. Mueller
Navy SBIR Program Manager
Crystal Plaza 5, Room 802
Washington, D.C. 20360-5000
Tel. (202) 692-2646

The Navy has identified 250 technical topics to which small R&D businesses may respond. A brief description of each topic is included along with the address of each originating office. This information is contained on the ensuing pages.

SBIR proposals shall not be submitted to the above address and must be received by the cognizant activities listed on the following pages in order to be considered during the selection process.

NAVY SMALL BUSINESS INNOVATION RESEARCH PROGRAM
Submitting Proposals on Navy Topics

Phase I proposal (5 copies) should be addressed to:

Topics #N88-001 through #N88-009

Mail/Handcarry Address:

Office of Naval Research
800 North Quincy Street
BCT #1, Room 528
Attn: Code OCNR 11SP, SBIR Program, Topic No. _____
Arlington, VA 22217-5000

Topics #N88-010 through #N88-026

Mail Address:

Office of Naval Technology
Attn: Code OCNR 20T
SBIR Program Topic No. _____
800 N. Quincy Street
Arlington, VA 22217-5000

Handcarry Address:

Office of Naval Technology
Code OCNR 20T, Rm. 811, BT#1
SBIR Program, Topic No. _____
800 N. Quincy Street
Arlington, VA

Topics #N88-027 through #N88-032

Mail Address:

Commandant of the Marine Corps
Headquarters, U.S. Marine Corps
Attn: Code LBC-2 SBIR Program, Topic No. _____
Washington, D.C. 20380-0001

Handcarry Address:

Headquarters, U.S. Marine Corps
1300 Wilson Blvd., Room 604 B
Attn: Code LBC-2 SBIR Program, Topic No. _____
Arlington, VA

Topics #N88-033 through #N88-047

Mail Address:

Commander
Space and Naval Warfare System Command
Department of the Navy
Attn: SPAWAR 10D, SBIR Program, Topic No. ____
Washington, D.C. 20363-5100

Handcarry Address:

Space and Naval Warfare Systems Command
National Venter #1, Room 1E58
2511 Jefferson Davis Highway
Attn: SPAWAR 10D, SBIR Program, Topic No. ____
Arlington, VA

Topics #N88-048 through #N88-056

Mail Address:

Commander
Naval Supply Systems Command
Department of the Navy
Attn: Code PML-5505, SBIR Program, Topic No. ____
Washington, D.C. 20376-5000

Handcarry Address:

Naval Supply Systems Command
Attn: Code PML-5505, SBIR Program, Topic No. ____
Crystal Mall #3, Room 517
1931 Jefferson Davis Highway
Arlington, VA

Topics #N88-057 through #N88-059

Mail Address:

Commanding Officer
Naval Medical Research & Development Command
Attn: Naval Medical Command, National Capital Region
SBIR Program, Topic No. ____
Bethesda, MD 20814-5044

Handcarry Address:

Naval Medical Research & Development Command,
Naval Medical Command, National Capital Region
Bldg. 1 (The Tower), Room 12147
Attn: SBIR Program, Topic No. ____
Bethesda, MD

Topics #N88-060 through #N88-072

Mail Address:

Headquarters, Naval Air Systems Command
Department of the Navy
Attn: Code AIR-9303D, SBIR Program, Topic No. _____
Washington, D.C. 20361-9301

Handcarry Address:

Headquarters, Naval Air Systems Command
Department of the Navy
Jefferson Plaza #1, Room 472
1411 Jefferson Davis Highway
Attn: Code AIR-9303D, SBIR Program, Topic No. ____
Arlington, VA

Topic #N88-073 through #N88-128

Mail Address:

Commander
Naval Sea Systems Command
Department of the Navy
Attn: Code CET-2, SBIR Program, Topic No. ____
Washington, D.C. 20362-5101

Handcarry Address:

Commander
Naval Sea Systems Command
Crystal Plaza #5, Room 924
2211 Jefferson Davis Highway
Attn: Code CET-2, SBIR Program, Topic No. ____
Arlington, VA

Topic #N88-129 through #N88-194

Mail Address:

Commander
Naval Surface Weapons Center
White Oak Laboratory
Attn: Code S-02, SBIR Program, Topic No. ____
Silver Spring, MD 20903-5000

Handcarry Address:

Commander
Naval Surface Weapons Center
White Oak Laboratory
Bldg. #1, Reception Room
Attn: Code S-02, SBIR Program, Topic No. ____
Silver Spring, MD

Topic #N88-195

Mail Address:

Commander
Naval Surface Weapons Center
Dahlgren Laboratory
Attn: Code S12, SBIR Program, Topic No. _____
Dahlgren, VA 22448-5000

Handcarry Address:

Commander
Naval Surface Weapons Center
Dahlgren Laboratory
Building 962, Room 129
Attn: Code S12, SBIR Program, Topic No. _____
Dahlgren, VA

Topics #N88-196 through #N88-201

Mail Address:

Commanding Officer
Naval Weapons Support Center
Attn: Code 6053, SBIR Program, Topic No. _____
Crane, IN 47522-5060

Handcarry Address:

Commanding Officer
Naval Weapons Support Center
Bldg. 2917
Attn: Code 6053, SBIR Program, Topic No. _____
Crane, IN

Topics #N88-202 through #N88-211

Mail Address:

Commander
Naval Weapons Center
Attn: Code 005, SBIR Program, Topic No. _____
China Lake, CA 93555-6001

Handcarry Address:

Commanding Officer
Naval Weapons Center
515 Blandy Avenue, Rm #22
Attn: Code 005, SBIR Program, Topic No. _____
China Lake, CA

Topics #N88-212 through #N88-214

Mail Address:

Commander
Naval Air Development Center
Attn: Code 094, SBIR Program, Topic No. ____
Warminster, PA 18974-5000

Handcarry Address:

Commander
Naval Air Development Center
Building #3
Attn: Code 094, SBIR Program, Topic No. ____
Warminster, PA

Topics #N88-215 through #N88-223

Mail Address:

Commander
Naval Underwater Systems Center
Commercair Acquisition Department, Building 11
Attn: Code 911, SBIR Program, Topic No. ____
Newport, RI 02841-5047

Handcarry Address:

Commander
Naval Underwater Systems Center
Commercair Acquisition Department
Building 11
Attn: Code 911, SBIR Program, Topic No. ____
Newport, RI

Topics #N88-224 through #N88-225

Mail Address:

Commanding Officer
Naval Air Engineering Center
Attn: Code 073, SBIR Program, Topic No. ____
Lakehurst, NJ 08733-5000

Handcarry Address:

Commanding Officer
Naval Air Engineering Center
Building #26
Attn: Code 073, SBIR Program, Topic No. ____
Lakehurst, NJ

Topics #N88-226 through #N88-227

Mail Address:

Commander
Pacific Missile Test Center
Attn: Code 3154, SBIR Program, Topic No. _____
Point Mugu, CA 93042-5000

Handcarry Address:

Commander
Pacific Missile Test Center
Bldg. #514, Room 113
Attn: Code 3154, SBIR Program, Topic No. _____
Point Mugu, CA

Topic #N88-228

Mail Address:

Commander
Naval Training Systems Center
Attn: Code 6, SBIR Program, Topic No. _____
Orlando, FL 32813-7100

Handcarry Address:

Commander
Naval Training Systems Center
Bldg. 2005, Reception Area
Attn: Code 6, SBIR Program, Topic No. _____
Orlando, FL

Topics #N88-229 through #N88-231

Mailing Address:

Commanding Officer
Naval Coastal Systems Center
Attn: Code 401, SBIR Program, Topic No. _____
Panama City, FL 32407

Handcarry Address:

Commanding Officer
Naval Coastal Systems Center
Bldg. 110 (Main Administrative Bldg), Rm 2M72
Attn: Code 401, SBIR Program, Topic No. _____
Panama City, FL

Topics #N88-232 through #N88-234

Mail Address:

Commanding Officer
Naval Civil Engineering Laboratory
Attn: Code L03B, SBIR Programs, Topic No. ____
Port Hueneme, CA 93043-5003

Handcarry Address:

Commanding Officer
Naval Civil Engineering Laboratory
Building 560
Attn: Code L03B, SBIR Program, Topic No. ____
Maritime Road & Market Street
Port Hueneme, CA

Topics #N88-235 through #N88-237

Mail Address:

Commanding Officer
Naval Air Propulsion Center
Attn: Code PE1A, SBIR Program, Topic No. ____
P.O. Box 7176
Trenton, NJ 08628-0176

Handcarry Address:

Commanding Officer
Naval Air Propulsion Center
Attn: Code PE1A, SBIR Program, Topic No. ____
1440 Parkway Avenue
Trenton, NJ

Topics #N88-238 through #N88-244

Mail Address:

Commander
Naval Ocean System Center
Attn: Code 0141, SBIR Program, Topic No. ____
San Diego, CA 93555

Handcarry Address:

Commander
Naval Ocean Systems Center
271 Catalina Boulevard
Trailer 28T
Attn: Code 216-B Supply Annex, SBIR Program, Topic No. ____
San Diego, CA

Topics #N88-245 through #N88-247

Mail Address:

Commander
David Taylor Naval Ship
Research & Development Center
Attn: Code 011.4, SBIR Program, Topic No. ____
Bethesda, MD 20084-5000

Handcarry Address:

Commander
David Taylor Naval Ship
Research & Development Center
Attn: Code 011.4, SBIR Program, Topic No. ____
Building 2, Room 109
Caroerock, MD

Topics #N88-248 through #N88-250

Mail Address:

Commander
Naval Air Test Center
Attn: Code CT-24, SBIR Program, Topic No. ____
Patuxent River, MD 20670-5304

Handcarry Address:

Commander
Naval Air Test Center
Building 304
Attn: Code CT-24, SBIR Program, Topic No. ____
Patuxent River, MD

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N88-001 TITLE: Novel Applications of Optical Phase Conjunction

CATEGORY: Research

DESCRIPTION: Develop new, highly innovative and novel applications of optical phase conjunction. Note that the common use of optical phase conjunction to eliminate aberrations is not a major interest in this program. Apart from this, specific interest would include the application of phase conjunction to such problems as improved optical gyros, novel position sensors, and other measurement schemes, particularly those that are quantum limited. The use of optical fibers and self-pumped phase conjugators is encouraged. The phase reversal property of optical phase conjunction has received comparatively little attention and is of special applications interest.

N88-002 TITLE: Nonstationary Stochastic Processes

CATEGORY: Research

DESCRIPTION: Develop new mathematical and statistical techniques for random detecting and classifying nonstationary and transient random signals in noise. Traditional approaches include spectral analysis via the short-time Fourier transform of Wigner distribution and finite parameterization via time-varying Auto-Regressive Moving Average (ARMA) models. More recent methods exploit the harmonizable and cyclostationary structure of transient and nonstationary signals. These new methods appear to permit the notion of coherence, which is important for distributed sensor systems, to be generalized. Research proposals need not fall into any areas listed, but must clearly address the problems of detection and classification in noise. In addition, an approach that emphasized rigorous mathematical analysis over simulation and experiment is preferred.

N88-003 TITLE: In-Situ Marine Instrumentation Systems

CATEGORY: Research

DESCRIPTION: Develop innovative techniques for real sea sensing of physical, biological, and/or chemical parameters in the marine atmosphere and/or the ocean water column. Parameters of primary interest include ocean temperature, current and/or salinity; ocean organism type, size, and/or concentration; ocean chemical species and concentration at nanomolar concentrations; and marine atmospheric wind, temperature and/or moisture. Techniques should measure these parameters and their high frequency variability in time and/or space.

N88-004 TITLE: Probabilistic Radar Inverse Scattering

CATEGORY: Research

DESCRIPTION: Formulate inverse radar problems as parameter estimation problems, using as parameters target shape (geometry), target materials (constitutive properties) and target kinematics. Develop practical methods for determining these parameters of a scattering obstacle from inexact knowledge of the far field pattern in the resonance and/or high frequency regimes. Because inverse problems of this type are both nonlinear and ill-posed, a natural mathematical approach is the use of nonlinear, constrained optimization methods. The optimization method should be tailored to the physical model from a collection of optimization methods designed for a variety of classes of physical problems. A body of literature exists for acoustic scattering by sound-soft obstacles in R^3 that bears on the electromagnetic scattering problem. Emphasis should be on the penetrable obstacles with classes of materials, determination of a set of features which are related to the target shape and/or constitutive parameters of the body, polarimetric effects, sparse or finite sets of data on complex shapes, and noisy observation. An understanding of the taxonomy of the problem complexity should be articulated (or graphed) such that approaches to the subsets of the complete problem can be evaluated within the taxonomy. Progressive solutions from direct methods, statistical assumptions, incidence angles, etc. to more complex combinations and larger variable domains are sought. Mappings of solution methods to tiers of problem complexity would be invaluable for focused Phase II efforts to apply selected methods to scattering data.

N88-005 TITLE: Liposome Sialidation

CATEGORY: Exploratory Development

DESCRIPTION: A need exists to develop methods for vocally coupling sialic acid to the external surface of liposome-encapsulated hemoglobin in order to test the capacity of this process to inhibit clearance by the reticuloendothelial system. The method must allow pyrogen-free, large-scale production sufficiently economical to permit future clinical use. The liposome-encapsulated hemoglobin or a formulation will be provided by a Navy contractor(s) and testing for reticuloendothelial and hematologic biocompatibility will be performed in collaboration with a Navy contractor(s).

N88-006 TITLE: Tactical Ocean Acoustic Environments

CATEGORY: Research

DESCRIPTION: The oceanic environment impacts the performance of current and future sonar systems, so approaches to construct acoustically significant environments for satellite sensors are important. Current efforts emphasize the role of ocean dynamic modeling as a key interpreter of remotely sensed observations. However, the great demand such efforts place on computer capability inhibits their use on board naval vessels in the near term, and contributes to the elapsed time between sensing and describing the environment. Methods are sought which complement and speed the modeling approach. Such methods should enable the direct utilization of satellite observations on board naval vessels, reduce the time for creation of the models' initialization fields, cut down on the number of computations required by the models, demonstrate or improve the accuracy of the modeled results, or speed the use of modeled results by the generation of tactically meaningful on-board graphic displays.

N88-007 TITLE: Improved Energy Storage Materials For High Frequency Power Systems Technology

CATEGORY: Research

DESCRIPTION: There is an urgent need to improve electronic power supplies. The present day technology produces power supplies which have peak efficiencies of 85% @ 5 volts (40-50% @ 2 volts) and power densities of 40 watts per cubic inch of power supply volume. The above represents the last accomplishments with the best in the electronic industry. However, if size compatibility is to be met for systems of the near future, such as VHSIC II, a breakthrough is needed to increase the efficiency to 95% @ 1.5 volts and provide power density up to 100 watts per cubic inch. A power supply must not be a dissipator; rather, it is a power conditioner which isolates, filters, changes voltage and current levels to meet detailed circuit needs. For example, logic circuits in the VHSIC require 3 volt DC levels at as much as 100 AMP current. The logic clock rates are as high as 100 MHz. Advances in power supply technology to the present time have been primarily accomplished through pulse width control circuitry and high frequency operation (up to 25 MHz in the laboratory). The increasing frequency has reduced the energy storage device volume, both in magnetics and dielectrics. The present state-of-the-art in the latter technologies has reached the limit of magnetic and dielectrics frequency characteristics. Both ferro-magnetic and dielectric (e.g., hi-K ceramics) materials degrade drastically at low megahertz frequencies. The ratios of energy storage to magnetic and dielectric losses reduce rapidly as frequency increases above 1 MHz. New materials must be developed to eliminate or relieve the energy loss problem at the required high frequencies. The reasons for increasing frequency to improve efficiency and reduce size are: (1) For a given energy storage per cycle, the power transmitted increased in direct proportion to frequency; (2) For a given power throughput energy storage decreases in proportion to cycle time; (3) For a given dielectric or magnetic material volume, there is a fixed maximum energy storage related to dielectric constant (*K*) of the dielectric or the permeability (*M*) of the magnetic material; and (4) The "*K*" and "*M*" properties degrade rapidly at frequencies about 1 MHz. Therefore, research and development is needed to produce: (1) Various new high frequency ferromagnetic materials for 25 to 100 MHz transformers and inductors. Ferrite materials with permeabilities greater than 50 and loss tangents less than .01 at 50 MHz could be candidates for investigation. Similarly, cobalt doped nickel-zinc materials have low, but constant permeabilities, however still an order of magnitude higher than air core; and (2) Capacitor dielectrics with low dipole orientation energy at

frequencies in excess of 50 MHz and carried out to identify the most promising materials, e.g., co-polymers which may exhibit the needed properties in the polyacetylenes radical.

N88-008 TITLE: Processes For Producing Multicomponent Ultrafine Microstructures

CATEGORY: Research

DESCRIPTION: There is increasing interest in materials having multicomponent ultrafine microstructures (i.e., a microstructural scale of 1 to 100 nm) and therefore useful mechanical, magnetic or optical properties. Processes are needed which can produce microstructures comprising two or more phases, with emphasis on metals and ceramics, which cannot be produced by solidifying the corresponding liquid. Fully dense materials having a granular or filamentary vs. laminar microstructure are of primary interest. Examples include ultrafine composites containing particulate tougheners/strengtheners, ultrafine metal granules embedded in a low conductivity matrix, cermets with biocontinuous phases, and unusual combinations of ceramics. The objective of this research is to explore the capabilities of processes which can produce such materials, in particular by understanding the mechanisms which determine the resultant microstructure as a function of process parameters.

N88-009 TITLE: Improved Glass Fiber/Thermoplastic Matrix Interaction

CATEGORY: Research

DESCRIPTION: Glass fiber reinforced thermoplastic composites currently do not have good adhesion between the fiber and the matrix. As large thick-walled composites will be required for future naval designs, it is incumbent to have techniques available that will permit utilization of these materials. Research is required on modifying the glass fiber surface and/or the thermoplastic resin material so that significant improvements on the composite shear strength, composite compressive strength, and resistance fatigue degradation during available fiber and matrix materials. The innovative research should result in a demonstration of improved properties and also an understanding of the mechanism involved.

N88-010 TITLE: Intelligent RDT&E Management Information System

CATEGORY: Exploratory Development

DESCRIPTION: Each Navy system uses an increasingly broad spectrum of technologies. Integrating and managing the many diverse technology developments has produced the requirement for intelligent management information systems. There exists a large number of innovative commercially-available, personal-computer software packages which possess some of the above attributes. The objective of this effort is to assemble available programs into an intelligent management information software system which can be implemented with personal computers.

N88-011 TITLE: Surface Ship Topside De-Icing

CATEGORY: Exploratory Development

DESCRIPTION: Operations in Northern latitudes present topside icing problems for all surface ships. Ice accumulations of greater than 3 inches are frequent. Present brute force removal methods are unsatisfactory. The objective of this project is to develop techniques for de-icing topside structures, machinery, equipment and sensors. Either portable or permanently installed systems may be considered. The development must be suitable for retrofit to ships already in the fleet. Installation concepts should be part of the proposal. Factors of cost, feasibility and applicability to combatant naval vessels should receive careful consideration in the development of the proposed techniques.

N88-012 TITLE: Unmanned Air Vehicle Systems Manager

CATEGORY: Exploratory Development

DESCRIPTION: Objective is to provide an Expert System concept design to control an Unmanned Air Vehicle throughout typical long endurance missions. The mission consists of flying a course from the base to a specific point, loitering on a station and returning. The system must determine the optimum flight path that maximizes fuel efficiency subject to the constraint of minimizing travel time. The system would utilize data inputs available after a determination of their relative reliability and accuracy. Phase I effort should address establishment of requirements for input data, data accuracy, data processing and the associated knowledge base. A later Phase II effort would include construction of a laboratory demonstration to confirm the concept design.

N88-013 TITLE: Hypervelocity Gun Technology

CATEGORY: Exploratory Development

DESCRIPTION: New and innovative gun technologies for Navy applications to close-in ship self defense against anti-ship missiles are sought which will increase lethality at increased keep-out ranges over conventional chemical population gun technology.

N88-014 TITLE: Tactical Theory For Weapons Effectiveness

CATEGORY: Exploratory Development

DESCRIPTION: A tactical theory of describing weapon effectiveness is desired in which the random variables that characterize the targets and the weapons are statistically dependent in a manner determined by the target-weapon configuration. The theory should provide more meaningful measures of weapon effectiveness based upon realistic considerations of how the weapon engages the target. Applications of this tactical theory of weapon effectiveness to ship self-defense tradeoffs are desired.

N88-015 TITLE: Clutter Rejection Signal Processing

CATEGORY: Exploratory Development

DESCRIPTION: Infrared surveillance sensors must discriminate unresolved targets against a cluttered background (clouds, sea, terrain). Define and demonstrate novel concepts for suppressing background clutter. Spatial, temporal, or polarimetric discriminants are suitable bases for a proposal. Of particular interest are nonlinear spatial operators such as medial filters. Contractors will be provided infrared clutter data for use in non-real-time simulation of clutter rejection techniques. Results of simulations will be compared to results obtained with conventional spatial filtering and adaptive thresholding approaches. A second phase would be initiated to optimize and adapt the process to a specific application and signal processor.

N88-016 TITLE: Multiple Adaptive Domains For Multisensor Information Integration

CATEGORY: Exploratory Development

DESCRIPTION: Integration of information from different types of sensors (fusion) is of growing importance in naval missions. For detection and classification functions, dissimilar sensors represent different domains. Searching different domains for correlated information introduces complexities of performing analyses in multiple domains. Simultaneous search in the multiple domains with feedback between the searches is an approach that contains fundamental heuristic search problems, applied sensor data issues and symbolic computing architecture consequences. Merging the numerical and symbolic aspects of the "n-sensor" fusion scenario into a feasible, non-

time critical computing architecture would be a reasonable design goal for Phase I. Evaluation criteria and implementation trade-offs accompanying the conceptual design would comprise a sufficient basis for proposing a Phase II prototype in a host simulator.

N88-017 TITLE: Database Modeling Methods For Real-Time Computer Image Generation

CATEGORY: Exploratory Development

DESCRIPTION: Investigate the state-of-the-art of database modeling for real-time computer image generation (CIG) systems, including methods used by animation developers. Develop and integrate software for a prototype system to run on a VAX (VMS) CAD style development environment having 1024 x 1024 resolution, 256 simultaneous colors, digitizer, plotter and/or printer. System capabilities should include: 2D and 3D object creation; rapid and simple editability; formats that permit easy conversion to target system; ability to specify level of detail, blending, shading, and sun illumination; ability to specify moving models; results displayable on graphics monitor or printer device.

N88-018 TITLE: Pilot Anti-G Concepts

CATEGORY: Exploratory Development

DESCRIPTION: Tactical jet air combat maneuvers expose pilots to conditions of +G acceleration which exceed their physiological capacity to maintain cerebral blood pressure. Under these conditions, loss of consciousness will occur. As a result, mechanical devices have been developed to produce counter pressures when internal pressures are increased by the aircraft's normal acceleration. Theory is that devices providing whole chest counter-pressure, full pressure half suits, etc. tend to keep the transmural pressure of blood vessels in the body relatively constant, thereby preventing pooling of blood and transudation of fluid. However, applications such as these to provide the pilot with increased protection during extremes of flight maneuvering have been limited due to technical practicality. Object of the task is the development of practical methods to provide a graded whole-body counter pressure to the head-to-foot acceleration induced pressure gradients experienced by pilots during conditions of high +G's.

N88-019 TITLE: Low Cost Power Tube Concepts

CATEGORY: Exploratory Development

DESCRIPTION: The system demand for Travelling Wave Tubes (TWTs) is climbing. In the extreme case of off-board countermeasures, the demand could be for 10,000 to 20,000 units. Present costs per tube is typically \$20K-\$50 K, and the best prognosis is for an off-board device in the \$6K range. Innovative concepts with potential to drastically reduce production costs below that possible by extensions of current manufacturing technology are desired. Possibilities are believed to exist in at least two general areas: (1) new simplified focusing systems or electronic guns to reduce the individual part count, and (2) applications of robotics or other automated equipment to replace current labor-intensive assembly operations.

N88-020 TITLE: Self-Deploying Large Array Structures

CATEGORY: Exploratory Development

DESCRIPTION: Large, lightweight, underwater structures which deploy at an ocean depth of 1000 ft after being launched in a compact package are required. The deployment structure shall be horizontally oriented and suspended from a surface float by a vertical cable to the center of the structure. The structure must support 4 sensor packages, each weighing 1 lib in water, and symmetrically located at a radial distance of 5 ft from the center suspension point. The structure must remain within +/- 5 deg of horizontal. Horizontal deviation of the sensor packages from their

design locations may not exceed 1 in. The structure must deploy from a cylindrical package of 4.75 in ID by 10 in high, with a total of 8 cu in of deploying without external power after a shelf life of up to 5 years. The approach should show growth potential for larger structures of similar design supporting additional sensor packages.

N88-021 TITLE: Advanced Propulsion Concepts

CATEGORY: Exploratory Development

DESCRIPTION: Develop concepts for advanced non-nuclear power/propulsion systems for autonomous vehicles with increased power densities over existing systems. Investigate combinations of power sources and propulsors, with emphasis on electrochemical systems including those which utilize oxygen extraction from seawater. Concepts should include a comparison of novel energy sources and state-of-the-art approaches coupled with energy systems that are compatible with the goal of extended, quiet, unattended operation greater than 30 days, at average power levels of 1 to 3 kilowatts. Analysis of energy sources should address issues of safety, weight, cost and modularity. Also, the analysis should include a parametric study of the performance of typical unmanned, untethered vehicles, and a risk assessment of the key power/propulsion system technology development areas.

N88-022 TITLE: Fuel Cell Auxiliary Power For Shipboard Use

CATEGORY: Exploratory Development

DESCRIPTION: The object of this project is to explore the feasibility, advantages and disadvantages of fuel cell auxiliary power sources for ships and submarines. The task is to develop fuel cell power system concepts and to make a comparison with both existing diesel electric and gas turbine systems. Considerations are the fuel type, oxidant type, compatibility with other fuels carried aboard, fuel cell efficiency, waste heat, and overall system efficiency. Comparisons are to include power output, power density, weight and volume, watts per kg, watts per meter³ and life cycle costs. The proposals shall be for systems that can provide 1000 Kw of electrical power for a minimum of 12 hours. The concepts can be a single fuel cell with this capability, or a distributed systems consisting of a number of smaller fuel cells which combine to 1000 Kw for 12 hours. It is expected that the proposals will be based on phosphoric acid fuel cell systems capable for operating on air; however, other types may be considered by the proposer.

N88-023 TITLE: Deep Sea Floor Penetrator For Geophones

CATEGORY: Exploratory Development

DESCRIPTION: Current research indicated that geophones buried a small fraction of a wavelength beneath the sea floor may provide a S/N environment superior to conventional sensors in the water column in the long period and short period frequency bands. Objectives of proposals should address; (a) sensors capable of measurements in both long period and short period frequency bands, (b) impact velocities necessary to achieve 30 meter (m) to 100 m depth of penetration, (c) shock isolation required for sensors, (d) onboard data processing equipment required to detect low-level signals, and (e) methods of rapidly transmitting data (real time or near real time) to the user.

N88-024 TITLE: Expendable Ocean Optical Transmission Sensors

CATEGORY: Exploratory Development

DESCRIPTION: A need exists for inexpensive, non-electronic, expendable sensors to measure the optical transmission properties of the ocean. The sensors would use only optics to sense and fiber optic links to transmit the ambient light field. Hydrodynamically designed bodies to permit straight constant fall rates are necessary to calculate accurate depth positions. The sensors should measure to a depth of about 300 to 400 meters and be suitable for both tropical and Arctic water use. One sensor should measure the downwelling irradiance as a function

of depth. A second sensor would measure hydrodynamically stimulated bioluminescent light. The sensors and data collection units should be compatible.

N88-025 TITLE: Superconducting Magnetic Sensors

CATEGORY: Exploratory Development

DESCRIPTION: Existing superconducting magnetic field sensors are fabricated by employing bulk technology (e.g., wire-in-groove sense loops, hybrid SQUIDS, shielded flux coupled assemblies, etc.) and superconducting materials with critical temperatures substantially below that of liquid nitrogen. Improvements in sensitivity and manufacturability could potentially be realized by transitioning to thin film technology; and SQUID electronics manufactured from new metal-oxide superconductors with critical temperatures compatible with liquid nitrogen refrigerators would circumvent the need for liquid helium. Potential feasibility and accrued improvements associated with either of these two approaches needs to be demonstrated through design, fabrication, and test/evaluation of appropriate sample sensor components.

N88-026 TITLE: Inertial Navigation System For Divers

CATEGORY: Exploratory Development

DESCRIPTION: An operational need exists for a compact, inexpensive inertial navigation system for use by divers and diver support craft. The basic objectives and constraints are as follows: (a) System size and weight must be compatible with use by divers using Navy free swimming equipment; (b) Positional accuracy must be 4 meters over a distance of 20 Km during an 8 to 12 hour operation duration; (c) Operational environment will be water at temperature from 28-100°F; and (d) Position information will be conveyed either visually or through audio means.

N88-027 TITLE: Hoseline Gap Crossing System

CATEGORY: Engineering Development

DESCRIPTION: During field deployments, the Marine Corps will periodically transfer fuel cross-country by pump and hoselines. A system is required to support hoselines for expedient crossings of streams and gaps. The system must be suitable for handling, erection and striking by field personnel using hand tools, and be deployable over a wide range of climatic extremes. Individual components must be sized to permit loading, unloading, and carrying by no more than two people. Specific technical requirements are for support of a static load of 30 pounds per lineal foot over a clear span distance of up to 500 feet. The design must also address dynamic loads such as surge, and environmental loads such as wind and ice. The Phase I effort will consist of system design and development of erection and striking methods. Phase II will consist of prototype fabrication, performance testing to validate structural integrity, provision of additional test items for government operational testing, and preparation of final designs.

N88-028 TITLE: Small Mobile Field Bakery Units

CATEGORY: Advanced Development

DESCRIPTION: The bakery equipment currently assigned to the Fleet Marine Force was designed during World War II. It is no longer supportable. Current RDT&E efforts are focused on very large bakery systems designed to support Marine Amphibious Force (MAF) sized operations. The bakery currently under DOD development cannot be subdivided below a Marine Amphibious Brigade (MAB) sized level of operation. Although large systems are needed, the disadvantage of large systems is a lack of flexibility to support smaller operations (1000-5000 Marines).

The Marine Corps needs a light, mobile field bakery that can provide bread for Marines in the field. Each bakery element should have the capability to support up to 1000 Marines with 8 ounces of bread per Marine each day, should be transportable by fixed wing air, helicopter internal and external, rail, ship, and motor transport by vehicles no larger than the M-900 series 5-ton truck. The deliverable for Phase I should be a detailed conceptual design for a bakery unit to support 1000 Marines in the field. Although not limited to Nondevelopmental Items (NDI), the design should attempt to capitalize on the integration of modern commercial bakery equipment and be packaged in such a way as to meet the transportability requirements.

N88-029 TITLE: Advanced Helmet Design For Head Mounted Displays

CATEGORY: Advanced Development

DESCRIPTION: Design and fabricated a light-weight helmet or headstrap: the device will fit to the head of an operator and be used to attach and position display surfaces accurately and reliably (i.e., without drift or unintentional movement) in relation to a wearer's eyes. The device must be easily and precisely adjustable for fitting to a variety of head sizes and shapes as defined by appropriate (USMC) anthropometric data. Adjustments should provide scale readings and positive locks for all critical settings. An individual user should be able to achieve a perfect or near perfect fit by adjusting to and locking in a list of settings appropriate to his own head shape prior to donning the device. The unit should be comfortable for up to several hours of uninterrupted usage and must not significantly impede blood flow to the scalp. The user should be able to speak in a normal voice without moving the displays relative to the eyes. For combat situations, it may be necessary to require that the device be overlaid by some type of hardened helmet.

N88-030 TITLE: High Resolution Color Cathode Ray Tube

CATEGORY: Advanced Development

DESCRIPTION: Design and fabricate a high resolution color cathode ray tube (CRT) with the same apparent resolution as the monochrome CRT's currently being procured. These must also meet or at least closely approximate all other significant criteria for the existing CRT's including ruggedness, size, removeability and size or drive electronics luminance output. Cost will be comparable to or less than that of currently procured monochrome CRT's. Such an improved color CRT is of potential application in enhancing thermal imagery in such Marine Corps developments as the teleoperated vehicle.

N88-031 TITLE: Holographic Target/Simulation Feasibility

CATEGORY: Advanced Development

DESCRIPTION: The technology of holographs is advancing rapidly. The military use of holographs to create multiple false targets or to simulate friendly forces for deception needs to be fully explored. The payoff in lives and equipment saved and threat resources expended could be tremendous.

N88-032 TITLE: Thermal Signature Suppression

CATEGORY: Exploratory Development

DESCRIPTION: Threat Military Forces have the capability to observe friendly forces with infrared observation devices. Although today's camouflage techniques can hide our forces from visual, radar and near infrared observation, heat signatures can still disclose the friendly order of battle. Thermal blankets, heat transfer units, etc. are generally bulky and immobile and do not solve the problem. The Marine Corps needs lightweight, mobile thermal signature suppression material/devices for the entire Marine Air-Ground Task Force (MAGTF) which defeats threat for infrared observation devices.

N88-033 TITLE: The Application Of The AN/GYC-7 To Expanding Digital Communication Requirements

CATEGORY: Management & Support

DESCRIPTION: The Marine Corps has recently developed a digital message switching device known as the AN/GYC-7. The architecture of the device is extremely flexible and lends itself to modification in order to meet various needs. A study is needed to identify future Marine Corps digital communications needs and what modification should be made to the AN/GYC-7 to allow it to meet those needs. This effort will include two steps. First, future Marine Corps digital communications requirements must be analyzed in the tactical and garrison environments, then the switch architecture must be examined. The resulting report should specify which future digital communications needs can be met by modifications to the AN/GYC-7, and what the modifications are.

N88-034 TITLE: Integrated Undersea Surveillance Event Data Language

CATEGORY: Exploratory Development

DESCRIPTION: A requirement exists to develop the syntax and construction of an Integrated Undersea Surveillance (IUSS) event data "language" to replace the numerical Abbreviated Tracking and Reporting Form (ATARF). The IUSS event data language must have a strict lexical construction with document standardization and it must be useable by multiple expert systems and other symbolic processors.

N88-035 TITLE: A Linear High-Power Digital Microwave Amplifier

CATEGORY: Engineering Development

DESCRIPTION: The current power amplifier in the AN/FRC-173 (V) digital microwave radio uses a traveling wave tube (TWT). The TWT is expensive, has a limited operating life and requires a long procurement lead time. A linear high-power microwave amplifier is needed that does not use a TWT.

N88-036 TITLE: Line/Feature Tracking Suite Of Algorithms

CATEGORY: Exploratory Development

DESCRIPTION: Increasing demands placed upon the Undersea Surveillance System (USS) require data processing techniques with the capability to identify low signal-to-noise signals in a background of incoherent noise. The need exists for a tracker providing not only the geographic positions of multiple contacts of interest, but also information concerning the contacts' dynamic characteristics. Such a tracking suite should provide information leading to localization and classification. Recent tracking algorithms have addressed low signal-to-noise, multiple targets, and other demanding scenario parameters. A suite combining these capabilities and others does not presently exist for USS applications. The Space and Naval Warfare Systems Command (SPAWAR) requires the development of a tracker suite of rule-based algorithms capable of tracking multiple contacts of interest. These algorithms should incorporate long-term automatic line integration and the ability to track dynamic sources. The suite should combine the unique aspects of all applicable algorithms, integrating these capabilities to resolve duplications and ambiguities.

N88-037 TITLE: Wideband Active Sonar Beamformer

CATEGORY: Engineering Development

DESCRIPTION: Sonars that use multiple pre-formed beams (scan within pulse) are much more effective than sonars that use a single, steerable beam. However, the phase shift beamforming used precludes the use of wideband signals. Wideband signals are desirable because of their greater resolution, reverberation suppression, and target discrimination capabilities. A method of beamforming that could be used for wideband echoes is to delay and sum

sampled data. In principle, this sampled data could also be processed with a replica correlator or matched filter to dechirp the signals. This task would analyze methods of beamforming and dechirping of signals with time bandwidth products of 16 or greater, and determine which are most computationally efficient with current and evolving electronics.

N88-038 TITLE: A Multiple-Path Routing Algorithm For Fault Tolerant Network Systems

CATEGORY: Advanced Development

DESCRIPTION: The improvement and increased reliability of networks and inter-networks necessary to produce an effective and reliable data communication system requires the development of a near fault-tolerant network system architecture as well as routing algorithms that can rapidly reconfigure and control network communications. Some of the issues associated with the development of such routing algorithms and multiple access protocols involve unique military requirements as well as very different data traffic patterns, data types, and transmission methods adapted by subnetworks. The Phase I effort shall include the development of multiple-path routing algorithms and data-base management techniques.

N88-039 TITLE: Data Compression Techniques For Storage Of Real-Time Video Images

CATEGORY: Engineering Development

DESCRIPTION: A requirement exists to store high resolution television type images in near real time on a magnetic media. At present, all of the raw video information is digitized and stored. Because of the high resolution and large video dynamic range requirements, primary system stress points/limitations are in high speed information transfer (throughput) and large digital storage requirements. A techniques needs to be developed which will enable high speed signal processing and data compression to occur before the video images are stored on a magnetic media. This program shall investigate algorithms, techniques and technology (which can be applied and demonstrated) to reduce the digitized video storage and data throughput requirements for high resolution, high dynamic range television type scanning video images.

N88-040 TITLE: Multi-Media Database Management For Navy Command And Control Information Systems

CATEGORY: Exploratory Development

DESCRIPTION: Database Management Systems (DBMS) have become indispensable components in most information systems. Conventional DBMS technologies have been successful in a variety of database applications which use formatted data such as integers and strings. The Navy Command and Control (C²) information systems differ from business or commercial systems in the following distinct characteristics: (a) Application environments require both data as well as unformatted data such as text, images, graphics, and voice. Such multi-media applications that require different kinds of less structured data are currently not well supported; (b) History information is one of the important data requirements. It is necessary to incorporate the time concepts in the design of the DBMS to support time varying information; and (c) To support the Navy C² functions, a friendly user interface for supporting multi-media data query as well as update is essential.

To satisfy the above requirements, current database technologies must be enhanced. While the need exists for the development of the multi-media database management system for the Navy C² systems, many important research issues need to be addressed: (a) Data model: Since a central feature of and DBMS is the data model upon which the system is based, a data model incorporating the time concepts for multi-media data should be first investigated; (b) Implementation of the proposed data model: This effort include research studies on the storage and management of large volume of unformatted data, access methods for handling multi-media data, concurrency control mechanisms, security capability, and performance, etc.; (c) User interface: A framework of user interface facilities needs to be provided for the multi-media data environment to support the Navy C² decision makers. The Phase I effort shall

include a proposed data model and an overall architecture. A working prototype of a multi-media DBMS should then be developed to demonstrate the specified features.

N88-041 TITLE: Sonar Detection And Classification With Two-Dimensional Filters

CATEGORY: Exploratory Development

DESCRIPTION: Develop novel techniques for sonar detection and classification utilizing two-dimensional Wiener filters. Provide specifications of the filter(s) and associated decision rule(s) suitable for implementation on commercially available mini or super-micro digital computers.

N88-042 TITLE: Joint Intercommunication Tactical Command And Control Systems

CATEGORY: Engineering Development

DESCRIPTION: The Joint Intercommunication Tactical Command and Control System (JINTACCS) message standard will be introduced into the naval message traffic system in the near future. A prototype message processor has been developed that is capable of dealing with a wide variety of standard message types. The system is generic in that message templates are represented as data sets rather than "hard wired" into code. New messages or changes can be implemented by preparing a new data set without modifying the software. The Phase I effort should involve the development of new template data sets for the JINTACCS message set.

N88-043 TITLE: Threat Assessment And Ranking For Anti-Ship Warfare

CATEGORY: Advanced Development

DESCRIPTION: The Navy has need for a surface warfare threat assessment capability which can rank and qualify (a) the general threat environment in the operations area or along the plan of intended movement (PIM), current and projected; (b) the threat posed by an individual surface ship, or a group of ships, with an estimate of their capacity to inflict damage on a designated ship, battle group or land site(s), and (c) the value of an individual enemy surface ship or to be developed with capability of running the IBM-PC/AT or HP-9020A with a target application being embedded in a mainframe Command and Control System.

N88-044 TITLE: Multi-Warfare Assessment Methodology Project Planning

CATEGORY: Management and Support

DESCRIPTION: The Space and Naval Warfare Systems Command (SPAWAR) is currently embarking on a project to develop a methodology for assessing multi-warfare combat capabilities. To date, the Navy has appraised each warfare area independently. Such a process was visible when the capabilities of potential enemy naval forces were insufficient to warrant coordination of naval assets. Now the emerging threat is rapidly becoming global in scope, very modern and extremely difficult to counter. For that reason it is critical that SPAWAR move forward to develop a modeling "tool" that will assess the integrated capabilities of the U.S. Naval forces while they face the combined arms of potential enemy forces.

As the Multi-Warfare Assessment Methodology Project matures, it will be important to define and understand the ramifications of such a tool on the Navy's overall planning process. In addition, it will be necessary to have mapped out a strategy for applying the methodology to enhance SPAWAR's architectural deliberations. To fulfill those important requirements it is necessary to: (a) Establish the relationship of the assessment methodology to the Navy's evolving planning process; (b) Define and outline the method for integrating the methodology of SPAWAR's overall warframe systems architectural process; (c) Assess the near-term impact of having such a tool on SPAWAR's architectural planning time-line; (d) Identify and outline the most effective method for presenting the

completed assessment methodology to the naval planning community; and (e) Define the role of each laboratory and Systems Command in future expanded warfare analyses. These elements are vitally important if SPAWAR is to maximize the results of this new warfare area assessment approach.

N88-045 TITLE: Ultrahigh Speed InGaAsP Diode Lasers

CATEGORY: Advanced Development

DESCRIPTION: A requirement exists to develop innovative new InGaAsP lasers for 1.3 μ m capable of being directly modulated to 20 GHz. These lasers are needed for their application to fiber-optic RF and microwave data and communication links. Such lasers must be frequency stable, reliable, have long operational lifetimes with minimal facet damage, and have minimum intermodulation distortion. The application of fiber optics to high frequency, wideband applications will have significant impact on Navy applications by providing Electromagnetic Interference (EMI)/Radio Frequency Interference (RFI) immunity, low weight and small volume, low life cycle cost, and high reliability.

N88-046 TITLE: Microwave Antenna Design

CATEGORY: Exploratory Development

DESCRIPTION: A requirement exists to design an S-Band Phased-Array Radar Antenna with a six-meter aperture. The antenna must be capable of radiating 10 terrawatts (10×10^{12} watts) of peak power without breakdown and exhibit 80 DB sidelobe suppression. Radiative elements must be transmission-line-fed impedance-matched adiabatic expanders, since no RF waveguide may be used. The design must allow for beam steering of 120 degrees in azimuth and 90 degrees in elevation.

N88-047 TITLE: Embedment Of Interface For Safenet (Local Area Network)

CATEGORY: Engineering Development

DESCRIPTION: Local Area Networks (LANs) are being developed to support the exchange of communications between computers. The Navy is closely monitoring this development to take advantage of the LAN technology built for commercial use but will make necessary modifications to ensure survivability in the tactical environment. As currently planned (for instance in the Electronic Warfare Control Module) the interfaces to these LANs will be external to computers. A major improvement to these interfaces will occur when the interfaces are imbedded (as has been done with the IBM Personal Computer LAN interface). Embedment allows use of the computer's operating system and/or Input/Output Interface Module to help control the LAN operation. External interfaces will be slower and less flexible. An additional attraction to embedded interfaces is the expected ten to one production cost reduction. The Phase I effort should involve the development of an imbedded interface for the Shipboard Advanced Fiber Optic LAN (SAFENET) for the Standard Navy Desktop Computer.

N88-048 TITLE: Fire Retardant, Water Impermeable, Vapor Permeable Microporous Coating For Fabrics

CATEGORY: Exploratory Development

DESCRIPTION: The Navy has a need for a microporous coating that is fire retardant and non melting which can be applied to fabrics under normal finishing or coating procedures to provide resistance to wind and water penetration while allowing passage of moisture vapor for comfort.

N88-049 TITLE: Fire Retardant Coated Fabric For Hazardous Chemical Handler's Protective Clothing

CATEGORY: Exploratory Development

DESCRIPTION: The Navy has a need for a liquid/vapor impermeable, flame retardant material for use in the manufacture of hazardous chemical handler's protective clothing. Required properties include self-extinguishing, non melting, impermeable to all known hazardous chemicals (liquid and vapor form), unaffected by all classes of petroleum, oil and lubricating products, flexible at temperatures from -40° F to 120° F, and possess a tear strength of 8 lbs. (min) warp and filling. Only those proposals citing development of materials incorporating use of novel polymerization techniques or other new technology will be considered.

N88-050 TITLE: Color Recognition Under Sodium Vapor Light

CATEGORY: Exploratory Development

DESCRIPTION: The Navy has a need for development of dye formulation additives that will allow the various colors of the flight and ganger deck identification jerseys and vests to be recognizable when worn under sodium vapor (monochromatic) light sources (as used on aircraft carrier flight decks) as well as under natural and normal artificial lighting conditions. It is suggested that dye formulations be developed containing additives that create specific reflectance bands in the visible spectrum when excited (activated) by radiation from the sodium vapor lamp. Required colors are red, yellow, blue, green, brown, purple, and white.

N88-051 TITLE: Alternate Buoyant, Flame Retardant Insulating Materials For Clothing Applications

CATEGORY: Exploratory Development

DESCRIPTION: The Navy has a need for a flexible, fire retardant, non-melting, non-foam, buoyant microfiber fiberfill insulating material. Material is required for incorporation into garments and handwear to provide insulation and positive buoyancy, while still providing comfort when used out of the water (provide means of vapor transmission away from the body). The material should be self extinguishing upon exposure to flame, be highly hydrophobic so that loss in insulation quality is 20% or less under a 24 inch hydrostatic head. The material should also provide good compression resistance (max 20% reduction) under a 24 inch hydrostatic head and good compression recovery after laundering and dry cleaning. Potential applications for this material include cold weather and anti-exposure clothing.

N88-052 TITLE: Stock Churn In Allowance Lists

CATEGORY: Advanced Development

DESCRIPTION: U.S. Navy shipboard and shorebase allowance lists have historically created an unacceptable rate of change in parts allowances which may not be fully explained by equipment or parts configuration changes or updates in parts replacement rates. Allowance shortages which have not been planned or provisioned result in parts requisitions which can put the Navy and Defense Supply Systems into short supply on parts or create stock out conditions. Allowance shortages also create unanticipated requirements for resources needed to fund requisitions for inventory deficiencies. Allowance excesses cause parts to be in long supply when turned into the supply system in addition to expenditures of resources for material turn in to disposal or take up stock within the Navy or Defense Supply System. A study/methodology is required to determine what is causing the allowance of changes and what actions should be taken to reduce inappropriate changes. Trips to Washington D.C. as well as several trips to the Inventory Control Points at Mechanicsburg, PA and Philadelphia, PA are required in the course of the project. Visits may also be required to sites at which ships off load excess material and requisition allowance deficiencies.

N88-053 TITLE: Expert System Advisor

CATEGORY: Advanced Development

DESCRIPTION: Technical personnel at naval Supply Centers (NCSs) are required to check for existence of a stock numbered item and for adequacy of data submitted by a customer. If submitted data are inadequate, the requisition is to be rejected back to the customer. In this essentially manual preprocurement effort, the technical personnel determine what the required item is, where it can be bought, how it is to be used and how much the item should cost. Technical personnel are also often required to construct the preprocurement information having available just the unmarked part or component in isolation without reference to the equipment or system from which it came. Today, technicians throughout Navy are essentially self-taught in investigation. An expert system advisor would embody the research procedures of the best NSC technicians and provide quality assurance, managerial feedback and training capabilities. An objective of this project would be to develop a teaching tool and advisory assistant for technicians throughout the Navy. The contractor is to determine and report, as part of the Phase I effort, the applicable range of Navy piece parts or components for a single technical expert system knowledge base. For example, is item knowledge so particularized that several, rather than one, knowledge base is required? A prototype expert system is required as a Phase I deliverable. Two trips to Washington D.C. as well as at least three trips to an NSC (East or West Coast) are required in the course of this project.

N88-054 TITLE: Decision Support System For Reverse Engineering Parts Candidates

CATEGORY: Advanced Development

DESCRIPTION: The DOD has a number of systems/projects addressing Diminishing Manufacturing Sources (DMS) situations. One of these, the Rapid Acquisition of Manufactured Parts (RAMP) will use electronic parts description data to manufacture parts on demand. Identification of RAMP candidates will result in a large universe of parts which may or may not have documentation in a format which can readily be used to operate the RAMP cell to make the part. The cost of developing the data for all possible candidates is cost prohibitive. This project requires development of a functional description detailing the methodology to determine the criteria for selecting those candidates for conversion data which will provide the best cost/benefit ratio to the Navy. Two trips to Washington, D.C. as well as several trips to the Inventory Control Points (ICPS) at Mechanicsburg, PA and Philadelphia, PA are required in the course of this project.

N88-055 TITLE: Industrial Demand Forecasting

CATEGORY: Advanced Development

DESCRIPTION: Historically, spare parts in support of industrial operations have been stocked in the supply systems based on provisioning estimates of replacement rates. These replacement rates generally reflect the expected replacement rate at the organizational level of maintenance. However, replacement rates at the intermediate and depot levels of maintenance will differ from the organizational level due to variations in maintenance philosophy, maintenance capability, technical repair standards, etc. A study is required to determine the feasibility of forecasting industrial demands with data currently acquired through MIL-STD 1388. If not feasible, changes to MIL-STD 1388 must be delineated to provide the required data. Trips to Washington, D.C. as well as Mechanicsburg, PA and Philadelphia, PA are required in the course of the project. Visits may also be required to sites at which ships off load excess material and requisition allowance deficiencies.

N88-056 TITLE: Single Demand Reporting

CATEGORY: Advanced Development

DESCRIPTION: Currently several reporting systems are in use to provide parts demand data. These systems vary depending upon differing requirements of several data systems. The Office of the Secretary of Defense (OSD) has

tasked the Logistics Management Institute (LMI) with a study effort for modernization of selected standardized procedures to provide the capability to satisfy all demand data requirements in a single reporting system. A study is required to consolidate Navy requirements for input to the LMI task and to identify unnecessary or duplicative reporting requirements. Trips to Washington, D.C. as well as several trips to the Inventory Control Points at Mechanicsburg, PA and Philadelphia, PA are required in the course of the project.

N88-057 TITLE: Rapid Test To Monitor Blood Mannose Levels

CATEGORY: Exploratory Development

DESCRIPTION: Patient monitoring for evaluation and treatment of impending septic shock complications is not as effective as necessary for timely treatment intervention in many cases. The best indicator of the status of septic shock remains unclear. Some experimental data has indicated that the monitoring of blood glucose and mannose may correlate well with septic shock severity. A simple, rapid test to monitor blood mannose needs to be developed to efficiently determine glucose-mannose ratios in septic shock patients.

N88-058 TITLE: Production Of Human Anti-Lipid A Monoclonal Antibodies

CATEGORY: Exploratory Development

DESCRIPTION: The use of monoclonal antibodies directed against the toxic lipid A component of lipopolysaccharide (LPS) has great potential for therapeutic use in septic shock. Free LPS plays a significant role in the induction of septic shock and multiple organ systems failure. Murine monoclonal antibodies against lipid A are of limited use in human therapy. The production and study of human monoclonal antibodies directed against lipid A are necessary for large scale trials. The proposed development area should produce a battery of human anti-lipid A monoclonal antibodies for use in screening and testing.

N88-059 TITLE: Isolation And Production Of Lymphokine Inhibitors

CATEGORY: Exploratory Development

DESCRIPTION: Lymphokines have been demonstrated to be important in the pathogenesis of septic shock. In particular, the macrophage lymphokine interleukin-1 (IL-1) plays a pivotal role in experimental septic shock models by adversely altering vascular contractility. Studies are desired that utilize lymphokine inhibitors as treatment options in septic shock. One inhibitor already identified by some investigators is tineastatin, a fungal component effective in inhibiting both IL-1 and IL-2 activities. This agent and other similar inhibitors should be isolated, produced and purified in adequate quantities in order to evaluate their treatment efficacy.

N88-060 TITLE: Signal Processing And Post-Processing Enhancements

CATEGORY: Advanced Development

DESCRIPTION: Signal processing and post-processing enhancements are needed in existing Air ASW systems to counter the quieter threats projected up to CY2000. Three areas are of interest: (1) artificial intelligence/expert systems approachers to relieve operator workloads and assist in target analysis; (2) sensor data fusion to integrate and correlate available intelligence from own/other force acoustic, Electronic Support Measurement (ESM), radar, infrared data, & satellites; (3) enhance signal conditioner. Arithmetic Unit (AU) processor, and mass storage capabilities to accommodate future sensors for mid 1990's, to include VSHIC, CMOS, optical disk as well as other technologies. Searches and studies will be conducted, in one or more of these areas, to determine what information and technology is available, what work is being done currently, and what the state of the art is expected to be in 3-5 years. Definitions/recommendations on the scope and direction of further research on each topic should be provided. If funding resources allow, assessments may be conducted to estimate Read Only Memory (ROM)

anticipated gains, relative to current Air ASW Systems, in timing, storage, operational effectiveness, or other criteria.

N88-061 TITLE: Low Frequency Transient Detection/Source Localization

CATEGORY: Exploratory Development

DESCRIPTION: A field of sonobuoys represents a sparse distribution array which, for certain transient signals could be processed using seismic techniques for source localization. In this topic, an investigation is required to examine the technique of migration as it might apply to low-frequency transient processing. The goal is to consider both algorithms and conceptual system configurations which should provide the airborne ASW unit with an additional tool for longer range detection of submarines. Various implementations of migration techniques should be examined, simulated and performance characterized for ideal and more realistic environments and buoy field geometries. Automated processing and alertments should be considered in the system concept.

N88-062 TITLE: Fault Tolerant Optical Repeater Couples

CATEGORY: Advanced Development

DESCRIPTION: A requirement exists to develop a fault tolerant optical fiber bypass repeater for use in optical local area networks. This device should be capable of operation in a military environment with non-mechanical techniques. Multiple bypass capability is essential.

N88-063 TITLE: High Output/Low Frequency Compact Active Transducers

CATEGORY: Advanced Development

DESCRIPTION: A requirement exists to perform design tradeoff studies and performance predictions for transducer elements of both conventional (e.g. PZT) and rare earth materials, to achieve element source level of 195 (minimum) to 205 (goal) dB/up@/m with diameters 4.5 and 6.5 inches and length between 6 and 18 inches, efficiency of at least 40%, frequency of 400-1000Hz, and Q of 10 or less. For selected design(s), fabricate arrays of 3 to 10 elements for Navy testing, maximizing source level for fixed package volume.

N88-064 TITLE: An/TPX-42A(V) 12 Fiber Optic Intra-Unit Communications

CATEGORY: Advanced Development

DESCRIPTION: The Phase I effort should involve a feasibility and design study to convert AN/TPX-42A(V)12 AATC-DIAR digital and analog data transfer between the Display Indicators, OD-200/TPX-42(V) and the AN/UYK-44(V) Computers, and the radar/Identification Friend or Foe (IFF) data transfer between the radar and the IFF source(s). The development of this network will provide improved data transfer, survivability, and weight reduction.

N88-065 TITLE: ASR-9 Radar/Air Traffic Control Interface

CATEGORY: Engineering Development

DESCRIPTION: A need exists for the design and development of a digital interface unit that would take the digital output from the new ASR-9 radars and reformat it to make it suitable as an input to the Navy Air Traffic Control (ATC) computer equipment. The ASR-9 radar is presently not compatible with the ATC system, thus the interface unit is necessary.

N88-066 TITLE: Aircraft Stability And Control Factors For Carrier Operations

CATEGORY: Exploratory Development

DESCRIPTION: A requirement exists to provide a theoretical approach for analyzing aircraft carrier landings for aircraft with advanced aerodynamic, propulsion, and control systems. The Phase I effort should include: (a) Identification of basic aerodynamic design factors which contribute to good carrier approach flying qualities and/or stability and control problems during landing operations, e.g. airframe and engine response, control system authority rates, computer lags, pilot cues, and external disturbances; (b) Description of these factors in mathematical terms and perform analyses to establish the relative importance of each factor's effect on the pilot's ability to perform the carrier landing task; and (c) Examination of specification parameters for comparison and propose alternate criteria for aircraft design, as warranted.

N88-067 TITLE: Radii Crack Initiation Prevention By Residual Compressive Introduction

CATEGORY: Advanced Development

DESCRIPTION: A requirement exists to investigate the feasibility and benefits of compressive residual stress introduction into radii of metallic airframe components. The development of a procedure which enhances fatigue life by inhibiting crack initiation could be applied to existing life limited structures as well as new airframe designs.

N88-068 TITLE: Caseless Ammunition

CATEGORY: Advanced Development

DESCRIPTION: A requirement exists for the development of caseless ammunition (50 Cal to 30mm) which will (a) Reduce the weight of ammunition; (b) Eliminate the retrograde requirements; and (c) Allow greater ammunition capacity in gun systems.

N88-069 TITLE: Laser Diode Arrays

CATEGORY: Advanced Development

DESCRIPTION: The requirement exists to develop fabrication techniques for uncoupled high power laser diode arrays. If such arrays can be successfully decoupled, sufficient power can be generated for a whole range of new laser applications such as laser imaging, laser proximity fuzes (air-to-air and air-to-ground), and the low cost integration of detection, guidance and control, and fuzing sensors into the same element.

N88-070 TITLE: Nondestructive Evaluation Of Ceramics

CATEGORY: Advanced Development

DESCRIPTION: The Phase I effort should be directed toward the development of a nondestructive inspection (NDI) System to detect surface and subsurface defects in ceramics and ceramic-matrix composite components. The NDI system shall have capability to do signal processing and data processing to determine defect characteristics and properties. This effort shall result in the design of an NDI system that can inspect large numbers of ceramic components quickly and at least semi-automatically.

N88-071 TITLE: Implementation of ADA Within Modular Airborne Tactical Mission Computer Software

CATEGORY: Exploratory Development

DESCRIPTION: DOD is strongly encouraging the use of the standard programming language Ada. Using Ada will provide benefits in software configuration management and use of standard programming tools now available for Ada. A requirement presently exists to investigate the feasibility of implementing the Ada programming language in airborne tactical software that is highly modular in design, i.e. Navigation, Tracking, Display, Data Link, etc. The tactical software in question is presently written in assembly language. The investigation should focus on the use of Ada as opportunities occur to modify software modules (sub-programs) to take advantage of enhanced mission hardware. For example, an improved tactical display would require significant modification of the Display sub-program. This investigation should address, but not be limited to, the impact upon the following: (a) available computer memory; (b) execution speed (throughput); (c) availability and use of automated Ada software development tools; (d) existing tactical/support software documentation; and (e) software configuration management by the USN Software Support Activity. When presented with a description of currently planned hardware enhancement, select the most promising enhancement for this software effort.

N88-072 TITLE: Application Of Color To Mission Displays Of The E-2C

CATEGORY: Advanced Development

DESCRIPTION: Complex mission requirements, multiple sensors, human factors and operator preferences make the presentation of tactical information to E-2C operators very complex and "busy". The current weapon replaceable assembly (WRA) supporting this function, called the Main Display Unit (MDU), is a monochrome Cathode Ray Tube (CRT) somewhat limited in capability. A new display referred to as Enhanced Main Display Unit (EMDU) is under development and will provide many improvements, one of which is the ability to vary the color of displayed application to a complex display environment with such time and mission critical ramifications as the E-2C, has not been fully explored. A study to determine the optimum application of color is required.

N88-073 TITLE: Atmospheric Effects On Fiber Reinforced Plastic Materials In Submarine Environment

CATEGORY: Exploratory Development

DESCRIPTION: A requirement exists to provide a technical and experimental assessment of the atmospheric effects on various Fiber Reinforced Plastic (FRP) material systems (fiber, matrix, construction) that would be applicable for use in internal submarine applications. The assessment should investigate items such as outgassing of the FRP at ambient conditions and elevated temperatures, the effects of fire including the generation of toxic gases, heat release rates, smoke and particulate generation. The investigation should recommend composite material systems and provide methods for assessing future FRP material systems for internal submarine use.

N88-074 TITLE: Damage Tolerance Of Fiber Reinforced Plastic Materials For Submarine Applications

CATEGORY: Exploratory Development

DESCRIPTION: Develop methods to assess the effects of damage scenarios that could occur singularly or in combination to selected submarine structures and provide recommendations for material systems that will demonstrate high damage tolerance for these applications. Scenarios of damage that could occur include, but are not limited to fires internal and external to the hull, underwater explosions, impacts caused by debris, tools and tugboats, abrasion of mooring lines, extended immersions in seawater, and contact with corrosive chemicals and fluids. Submarine internal applications include, foundations, decks, bedding plates, hatches, ventilation ducts, and gear covers. External applications include control surfaces, air flaps, propellers, sail, masts, and fairings. The material system assessment should include the effects of variations of fiber and matrix materials, material orientations, and fabrication methods to obtain high damage tolerance characteristics.

N88-075 TITLE: Multipath Modeling

CATEGORY: Exploratory Development

DESCRIPTION: Shipboard radars are subject to ducting phenomena which can cause variations in detection ranges depending on atmospheric conditions and frequency bands. Although some work has been accomplished for monostatic radars, models need to be developed for bistatic radars. Develop bistatic models for conditions with surface and evaporation duct phenomena against low flying missiles including effects in all sea states.

N88-076 TITLE: Analysis Of Low Flying Missiles Versus Various Sea States

CATEGORY: Exploratory Development

DESCRIPTION: Various sea states can cause different effects on the aerodynamic capability of low flying missiles and aircraft. Investigate the effect of sea state on altitude capability of low flying missiles and aircraft. The investigation should also include models for subsonic and supersonic speeds.

N88-077 TITLE: Frequency Modulation on Pulse Transmissions

CATEGORY: Exploratory Development

DESCRIPTION: Investigate the feasibility of conducting measurements of production radars to identify frequency modulation on pulse transmissions. The investigation should include how measurements would be taken at the factory and in the field.

N88-078 TITLE: Expendable Sea Surface Temperature Measurement Device

CATEGORY: Advanced Development

DESCRIPTION: There is a need to develop at a low cost, an expendable device for remote sensing of sea surface temperature out to the radar horizon of a surface unit. This device would be required to give real time readout of temperatures from a remote station.

N88-079 TITLE: Heads-Up Display for Shipboard Use

CATEGORY: Engineering Development

DESCRIPTION: Heads-up display technology has been used for a number of years in aircraft. This technology may have applications for shipboard use. The Phase I effort should be directed to developing a prototype that will display to the shipboard watchstander items of interest using heads-up display technology.

N88-080 TITLE: Naval Usage of Realtime Holographic Display Systems

CATEGORY: Advanced Development

DESCRIPTION: Holographic techniques could provide a better perspective of the three dimensional battle if available in real-time. Design and develop the use of real-time holographic displays for shipboard use. This design should allow for extremely dynamic situations in three areas of warfare: Air, Surface, and Sub-Surface.

N88-081 TITLE: PC Based Model For The ARGIS Weapon System

CATEGORY: Engineering Development

DESCRIPTION: The power of current personal computers now make them a candidate to support wargaming efforts. One use would be to model the AAW Systems of current combatants allowing the wargame umpire to correctly score various engagements. The purpose of this effort is to develop a PC based model to score a variety of simultaneous AAW engagements.

N88-082 TITLE: Real-Time Shipboard Seaway Sensor

CATEGORY: Exploratory Development

DESCRIPTION: The contractor will perform a study to determine the scientific and technical feasibility (using existing or new technology) of measuring in real time wave height, wave period, and directionality of the insitu sea conditions aboard ship. Such a seaway sensor is required to interface with Tactical Decision Aids for improved operational capabilities in the northern latitudes for our existing monohull fleet. Moreover, such a system will improve ride control systems on advanced vehicles. Areas to be investigated should include but are not limited to radar, optical laser, or sonic shipboard units. Items of interest are weight, space requirements, cost, and system accuracy.

N88-083 TITLE: Suppression of Explosion Shock Energy

CATEGORY: Exploratory Development

DESCRIPTION: The purpose of this task is to investigate the feasibility of applying the shock attenuating properties of aqueous foams to mitigate the destructive consequences of warheads detonating within a ship's structure. Internal detonations of warheads come from two sources. One source is from delayed fuzed weapons penetrating the ship's outer skin and exploding in a space within the ship. Another source is from the ship's own weapons that are detonated by ballistic fragments or by the shock wave of nearby explosions. These weapons might be enclosed in above deck launch containers or within the ship magazines. Aqueous foams will decrease the pressure generated by an explosion. Research indicates energy in a shock wave generated by an explosion will be consumed in converting the foam into water droplets and the subsequent droplet evaporation. Space and weight are critical ship design considerations directly affecting mission payload and ship acquisition and operating costs. This project would identify innovative approaches to incorporating aqueous foam barriers in a ship's structure and identify further research related to modifying foam characteristics to make this concept feasible.

N88-084 TITLE: Accelerated Stress Corrosion Cracking Screening Test Method For HY-130 Steels

CATEGORY: Advanced Development

DESCRIPTION: Weld material is the limiting material in determining the stress corrosion cracking (SCC) resistance of HY-130 steel weldments. Currently, no 135 Ksi yield strength weld material exists which consistently produces welds having the requisite mechanical properties and high resistance to stress corrosion cracking. A need exists to develop a rapid test for screening new weld material and base material formulations for SCC resistance. The contractor shall develop a small specimen accelerated test method for determining the stress corrosion cracking resistance of HY-130 steels and weldments. The environment of principle concern is natural seawater at ambient temperatures with steels under cathodic protection. Data from the accelerated test shall be capable of being correlated with data and parameters, such as stress intensity for crack initiation, produced from traditional long term stress corrosion cracking test methods. The accelerated test shall be reproducible and capable of being utilized as a rapid screening test for HY-130 steels in wrought, cast and deposited weld metal forms.

N88-085 TITLE: Fire, Toxic Gases And Chemical Agent Detectors

CATEGORY: Advanced Development

DESCRIPTION: Requirements for personnel protection, fire detection and related chemical defense aspects call for detectors of fire, toxic gases and chemical agents. The need is for the development of detectors which react almost instantaneously to the lethal environment; provide accurate identification of the causes; are small; possess long storage life and will operate in all types of Navy operational environment. A desirable characteristic is also that of easy incorporation in Navy shipboard systems. Phase II of the effort will be to field test promising devices.

N88-086 TITLE: Ice Shedding Materials For Surface Ship Applications

CATEGORY: Exploratory Development

DESCRIPTION: Operation of surface ships and craft in the Northern latitudes are adversely effected by problems related to ice build-up and ice removal procedures. Readiness and safety can be impaired by ice formation and build-up. Advanced coatings and other innovative materials concepts are required which can prevent or reduce ice build-up and ease removal. The contractor shall document the status of domestic and foreign, commercial and military materials technology being applied or being developed to prevent or reduce ice build-up problems. Emerging materials and concepts should be included as well as existing material systems. The contractor shall also develop an assessment methodology which considers at least the following factors: cost, technical risk, environment implications and total ship impact. Based on this review and assessment procedure, at least three promising materials technologies and concepts should be identified along with outline of required actions necessary for reliable application.

N88-087 TITLE: High Frequency Acceleration Measurement

CATEGORY: Advanced Development

DESCRIPTION: The need exists to make accurate measurements of structureborne vibratory acceleration levels in ranges above 12 kHz at acceleration levels of 50dB re 10Mm/s². Proposals should address methods for accelerometer attachment, including studs and adhesives, valid for measurements to 20 kHz at acceleration levels of 50 dB re 10Mm/s². Methods for measuring higher frequency acceleration levels of 20 kHz to 50 kHz at 50 dB re 10 Mm/s², should also be addressed. In addition, calibration capabilities for higher frequency measurements are needed for each method which addresses shaker tables, procedures and traceable reference standards. Proposals should also address each of the areas outlined above for measuring structureborne vibratory acceleration levels on surfaces with temperatures up to 600°F.

N88-088 TITLE: Shipboard Individual Protection System

CATEGORY: Exploratory Development

DESCRIPTION: Operational requirements exist to improve the effectiveness of damage control (DC) and firefighting (FF) personnel under shipboard disaster conditions. Fleet experience has demonstrated that improved DC/FF capabilities are essential in light of the increasing magnitude of multiple-hazard shipboard threat environments. These improved capabilities rest on incorporation of modern technology and an overall systems approach to design improved individual protective systems. Thus, systematic approach is needed to define a protective system for the individual that supports the efficient and effective accomplishment of the DC/FF mission under all natural or induced environmental conditions. Phase I of the proposed effort will produce a System Concept Definition based on operational requirements and the shipboard threat. Functional Flow diagrams will be produced to an appropriate level of detail for identifying systems and components, and Functional Descriptions will be written to define each function, identify inputs/outputs and define performance criteria. Phase II would continue

the Systems Engineering function and define technologies to be used or developed and describe the performance levels of hardware and software using Phase I documentation for definition.

N88-089 TITLE: High Reliability Diesel Fuel Injection System

CATEGORY: Advanced Development

DESCRIPTION: Design and assemble a small scale pilot system which will insure that the fuel supplied to a diesel's fuel injector is free of detectable foreign material including water. The system shall alarm with either a sudden increase or a gradual increase in contamination that threatens to exceed pre-set limits. Components shall be state of the art but arranged in such a way as to maximize reliability of performance and maintain simplicity. A demonstration with intentional contamination shall be made to verify sensitivity and effectiveness.

N88-090 TITLE: Air Quality Sensor For Submarines

CATEGORY: Advanced Development

DESCRIPTION: In the closed ventilation system of a submarine, certain gases such as H₂O, CO, CO₂, and NO_x pose a hazard in high concentrations. Novel methods are sought for sensor systems to monitor these contaminants and others. The proposed systems should offer reduced cost and size, Electromagnetic Interference (EMI) insensitivity and must provide no explosion hazard. In addition, systems with improved detection limits, range of insensitivity, or other advantages over current gas monitors are encouraged. The goal of Phase I development effort is the design and demonstration of a novel sensor for one or more gas contaminants.

N88-091 TITLE: Shipboard Hazardous Waste Management

CATEGORY: Advanced Development

DESCRIPTION: Development of innovative procedures, processes, operations, and systems to treat and manage shipboard industrial and hazardous wastes. More stringent domestic and international environmental regulations require improved shipboard methods for waste management, with minimal demand for manpower, energy use, space, and additional ship's weight. Methods must be suitable for backfitting onto existing ships or incorporating into new ship designs. The Navy must comply with hazardous waste control regulations, oily waste discharge restrictions, and operational restrictions in environmentally sensitive waters. Improved conventional or innovative biotechnological approaches to shipboard waste management are solicited.

N88-092 TITLE: Freon Detector

CATEGORY: Advanced Development

DESCRIPTION: The introduction of Freon into a confined space from a refrigerant leak can pose a significant risk to Navy crew members through oxygen deprivation. Monitors to detect Freon in the atmosphere are required to protect Navy personnel. Both permanently mounted instruments for area monitoring and portable personnel monitors are required. It is desired that the sensors be compatible with a distributed fiber optic shipboard sensor system.

N88-093 TITLE: Water Quality Monitor

CATEGORY: Advanced Development

DESCRIPTION: A Navy vessel processes, utilizes and discharges water of a wide variety including potable water, bilgewater, boiler feed-water, boiler condensate, cooling water, gray water and sewage. It is conceivable that a single all-purpose instrument capable of measuring the quality of these waters for a number of contaminants and/or parameters is within present state-of-the-art. A water quality monitor to measure all or most of the characteristic mentioned above would be of interest. Proposers knowledgeable in analytical concepts are encouraged to submit proposals for development of such a device for shipboard application.

N88-094 TITLE: Energy Sources For Small Submarines

CATEGORY: Exploratory Development

DESCRIPTION: Compact energy sources capable of delivering power in the 20-50 kilowatt range for periods of 100-200 hours (2,000-10,000 kilowatt hours) are needed for use in small, untethered, unmanned submersible vehicles. These vehicles typically weigh 3,000-6,000 kilograms and have volumes of 12-20 cubic meters. They can be used at all depths for search, inspection, and work tasks, but their endurance is limited by available energy sources, usually batteries, to a few tens of hours. Dynamic converters (external or internal combustion engines) are more space and weight efficient than batteries and are less expensive than fuel cells. Obstacles to their adoption include volume limitations on fuel storage, disposal of waste heat, and control of noise, but the most serious is disposal of exhaust products, especially for hydrocarbon fuel systems. Overboard dumping in general is not desirable and at great depths is not feasible. A study is needed to identify fuel systems which combine high efficiency with low-volume exhaust levels, together with a compilation of methods by which the exhaust products can be collected and stored. A number of different systems should be presented, with the weights and volumes needed for fuel and exhaust storage included as a function of the energy deliverable by each system. The study should be directed toward construction of a laboratory model in Phase II.

N88-095 TITLE: Target Detector

CATEGORY: Advanced Development

DESCRIPTION: It was determined that an infrared sensor is the best approach for improving target detection for the fuze of the Rolling Airframe Missile (RAM). The technical problem is to develop the capability to detect targets and at the same time to reject background features over the wide range of environmental conditions experienced in a RAM application. Also target detection capability in low contrast and in negative contrast situations due to low emissivity targets must be quantified. Discrimination against various background features must be determined. Of particular interest are: (a) Sun reflections off the (sea) surface or off clouds at both low and high altitude; (b) Cloud images in the sea; (c) Effects of varying surface emissivities resulting from white caps, oil slicks, floating debris, kelp, etc.; and (d) Performance with land cloud backgrounds. In addition, the fuze must discriminate against the reflection of the missile target. The capability of the fuze to reject false targets as well as own ship-launched infrared decoys needs to be characterized.

The purpose of this work is to conduct a two phase risk reduction program on an alternate fuze development for the RAM. Phase I will include the analyses, trade studies and simulations needed to develop a fuze design concept. Phase II will include a detailed design for use in fabricating breadboard models for laboratory testing. Specific factors to be released are: (a) Spectral optimization; (b) Sensitivity requirements; (c) Need for cooling; (d) Background discrimination techniques and threshold logic; (e) Window performance limitations in adverse environment (rain, sleet, very cold weather); and (f) Approximate available volume is a cylindrical section 5 inches in diameter and 6 inches long.

N88-096 TITLE: Thermal Management Of High Heating Loads

CATEGORY: Exploratory Development

DESCRIPTION: Dissipation of rapidly generated, very high heat loads in components of naval weapons, ship, and submarine systems is becoming an increasingly difficult problem as systems performance requirements are

increased. Recent development of ultra-high thermal conductivity (three times that of copper) graphite fibers can provide a possible solution to this problem. The new fibers can be combined with organic, metallic or ceramic matrix materials to design and fabricate composites which will conduct heat out of hot components while providing thermal expansion matching and satisfactory mechanical properties. Working with the highest thermal conductivity graphite fibers available, the Phase I Program must demonstrate the capability and relative merits of unidirectional, cross-plyed, and woven cloth reinforced composites for rapid removal of heat from typical Navy system components. If the expected performance is demonstrated, a recommended program plan for development of thermal management systems for selected weapon and platform components should be provided for possible implementation in Phase II.

N88-097 TITLE: Insensitive Munitions By Chemical Means

CATEGORY: Exploratory Development

DESCRIPTION: By 1995 all Navy weapons must meet guidelines for insensitivity to unplanned stimuli. There are several mechanical means to lower the sensitivity of munitions to shock, fire, and impact, but none are entirely satisfactory. If a munition could be made insensitive by a chemical means it would be innately insensitive and the mechanical means with its possibility for malfunction could be eliminated. The purpose of this project is to determine if there are any chemical means of reducing the sensitivity of rocket motors to unplanned stimuli. The Phase I effort requires the use of chemical theory to screen and collect basic chemistry ideas for synthesizing insensitive energetic compounds for use in rocket motors or other munitions, and check the availability, new insensitive energetic compounds for what is presently used. The Phase II efforts would involve formulation and small scale testing of propellants for insensitive rocket motors.

N88-098 TITLE: Impulse Radar Technology

CATEGORY: Exploratory Development

DESCRIPTION: The Phase I effort should be directed at conducting a survey to identify existing technology applicable to subnanosecond impulse radar implementation. Specifically, sources are to be identified having (a) high power, subnanosecond, photoconductive switches and fast trigger lasers; (b) low noise, very wideband, nondispersive EM receivers; and (c) wideband nondispersive emitter elements suitable for matching subnanosecond baseband pulses to free space radiation. The Phase II effort will involve: (a) The fabrication and testing of a single element, subnanosecond, impulse radar emitter and receiver combination. Also measure emitter field patterns and investigate reflection and multiple point scatter properties for various target structures; (b) Assembly of a multiple element, impulse radar emitter array consisting of at least three emitter elements with fiber optics and laser triggering of impulse trains of various lengths; (c) Conducting EM field tests using the emitter array in various configurations to investigate: beamforming time delay, inter-element interference, suitable backplane reflector and/or absorber configurations, and sidelobe levels for single emitter and emitter arrays; (d) Conducting experiments using the element array and a suitable receiver with instruments to record and/or display target returns from simple structures at various ranges; (e) Investigate various detector and signal processing alternatives using single pulse and multiple pulse, matched filter (coherent) detection; and (f) Generation of a report containing recommendations for further development of impulse radar components and system concepts.

N88-099 TITLE: Ductility Enhancement In Ti_3Al

CATEGORY: Exploratory Development

DESCRIPTION: Intermetallic compounds with low density and good mechanical and creep properties at high operating temperatures are needed for applications in advanced missiles, aircraft, and spacecraft. Titanium aluminide (Ti_3Al) is one such material under development at this time. However, its potential for use as sheet material or as a matrix for reinforced metal matrix composites is limited by its low ductility. Recent studies to improve performance of Ni_3Al material properties indicate that there is potential for increased ductility. The

objective of this effort should be to assess the impact of addition of various alloying constituents (e.g., boron), range of alloy concentration, effect of grain size, and temperature dependence on Ti_3Al material properties. The desired result, based on modeling relationships, would be an assessment of the potential for properties improvement, and recommendations of alloying elements, processing steps, etc., to obtain the enhanced property values.

N88-100 TITLE: Projective Spin Sensor

CATEGORY: Advanced Development

DESCRIPTION: Initial muzzle velocity variations of Navy large caliber gun systems lead to range inaccuracies. Since muzzle velocity and projectile spin rate from that of the proportional, a spin sensor which would accurately measure the small difference in projectile spin rate from that of the predicted or nominal spin rate would offer a means of adjusting for variations in muzzle velocity. Such a device would offer major advantages in obtaining precise burst positions with time fuzes and precise proximity "turn-on" time in Controlled Variable Time (CVT) Fuzes. Minimum "on-time" is desired to minimize the chance of fuze jamming. The Phase I effort should include the investigation of devices capable of measuring spin rates of Navy projectiles operating at spins from 60 to 450 revolutions per second and capable of detecting changes in spin rate of $\pm 1\%$ from the predicted nominal value. Even greater accuracy is desired. The device(s) must be capable of being packaged in a volume not to exceed that of a TO-8 transistor can. If multiple sensors are required to meet the desired spin accuracy over this packaged in a volume not to exceed that of a TO-5 transistor can. Any device must be capable of withstanding axial forces (along the projectile length) of 75,000 g's and cross axial forces of 20,000 g's. The projected packaging size must be indicated as well as the number of required devices per fuze, the technology status (repackaging of existing items onto a single chip or a development effort), and the predicted accuracy over spin range and estimated production cost in quantities of 25,000 per year.

N88-101 TITLE: Design Architecture Of Multi-Function Electromagnetic Arrays

CATEGORY: Advanced Development

DESCRIPTION: Many efforts are being made in industry and government to develop elements for arrays. However their goals are focused towards different functions. The opportunity is coming to be able to integrate the functions of Radar, Electronic Warfare (EW), Identification Friend of Foe (IFF), Communications and Navigation in the same arrays. The opportunity is also coming to be able to have the systems entirely within the arrays as modules on the outside structure of the ship, aircraft or land vehicle. This would have the advantages of wide frequency coverage with less surface area, volume, cost, radar cross section and more survivability and efficiency of power usage. The efforts can be made more focused if there were a pilot design effort for an Advanced Development Model (ADM) demonstration unit for a L & S band array. The design could start by addressing the architecture required for processor receiver, transmitter and antenna modules. The first phase would be an industry/government survey to find the best applicable technology. The second phase would produce a proposed architecture and specifications for the modules and system. The project could then be transitioned into building and array ADM.

N88-102 TITLE: Development of High Purity Intermetallic Beryllides

CATEGORY: Exploratory Development

DESCRIPTION: Beryllides are a class of intermetallic materials which have high potential for uncooled operation at temperatures up to 1900°C. As such, they are candidates for future very high speed missile system components and turbine engines for propulsion systems. However, development has progressed slowly, and available data is on impure materials with less than theoretical density. The products of the Phase I effort will be: (a) An analysis of available data to determine current development status, (b) Identification of analytical techniques which can be used to minimize beryllium development costs; and (c) A research and development program plan which can be implemented in a Phase II effort.

N88-103 TITLE: High Char Yield Polymer Matrix Composites

CATEGORY: Exploratory Development

DESCRIPTION: Reinforced organic matrix composites materials offer excellent structural properties for missiles and high speed aircraft. However, performance at high temperature is limited, particularly in enemy induced environments, e.g., laser weapon attack. Carbon matrix composite materials are ideal in the high temperature environment, but lack impact resistance and are difficult to handle and assemble in the thin structures required for advanced Navy systems. The objective of this effort is to develop organic matrix composites that will form in-situ carbon-carbon when subjected to very high operating temperatures, without detriment to the systems performance. The program should be conducted on polymers similar to "H" resin, which produces a char yield above 90%. Phase I should demonstrate fabrication and property translation from the graphite fiber reinforced polymer to the carbon-carbon composite created from the high char yield polymer. Evaluation of both polymetric and carbonized properties should be made.

N88-104 TITLE: Source Code Tailoring

CATEGORY: Advanced Development

DESCRIPTION: Among the many software engineering concepts developed to increase programmer productivity, one of the most promising and most sought after is reuse of existing, proven software. One technique for software reuse is to take an available tested software component which has reasonable general applicability within a limited domain (e.g., track correlation algorithm) and determine the useful ways in which it can be varied to support similar applications. A version of the component is produced with embedded symbols indicating potential variations and the domain or condition associated with the variation (e.g., for ship class XX include SPY radar returns as a reporting source). This version is called the "archetyped source". The installation of the archetyped sources as actual source code for a specific application (e.g., ship class XX) is termed "source code tailoring". Available techniques include: (1) language and symbology for denoting variants, (2) variant generators, (3) facilities for explicit association of domains with both variants and variant generators, and (4) facilities for test scripting, execution and evaluation as part of the support for the tailoring process. Source code tailoring can be a particularly useful technique for military applications, wherein a set of platforms perform a common set of functions, but each platform varies somewhat with respect to its sensor, weapon and communication interfaces. Thus, the common functions can be designed, "archetyped" for the platform population, and platform-specific versions, all having data and algorithmic commonality. Although a limited degree of source tailoring has been present for many years in DOD software (e.g., parameterization of table sizes, compiler directives ("C" switches), macro-assemblers, and now with Ada generics, the "actualized" until these techniques have been "adapted" for use in Navy system developments and demonstrated in a realistic military application.

N88-105 TITLE: Real-Time Assessment Of Operator Workload During Tactical Decision Making

CATEGORY: Exploratory Development

DESCRIPTION: The potential threat facing Navy surface ships in tactical situations is becoming increasingly complex. As a result of this, many tactical scenarios entail saturation attacks of force defensive systems to overload defensive capability, using diverse and multiple threats. Concomitant with this is an abundance of data from a variety of on-board and remote sources. One result of this is a high probability of decision maker unreliability due to sensory and cognitive overload. In these situations, a tactical doctrine is to transfer some decision making responsibility to automated systems. A major shortcoming of this approach is that it relies on the humans own assessment of his ability to keep up with the requirements of the tactical situation and resulting cognitive workload. Self assessment of cognitive workload has been demonstrated to be an unreliable measure. What is required are methods to estimate, in real-time, human workload and to predict impending over-workload and possible resulting human decision unreliability. Thus, innovative research is needed in the areas of real-time workload assessment under conditions of tactical decision making. Topics to be considered under this area include:

- (a) Human Information Processing and Related Capabilities
 - sensory/perceptual
 - decision making
 - reaction time
- (b) Weapon and Sensor System Capabilities
 - response latency
 - accuracy/reliability
 - inventory/depletion
 - engageability factors
- (c) Hostile Force Capabilities
 - second strike
 - range, speed, accuracy
 - countermeasures
- (d) Tactical Situations
 - attack scenarios, profiles
 - information uncertainty
 - battle group capabilities, missions

N88-106 TITLE: Multi-Language Software Support Requirements On Integrated Software Engineering Environments

CATEGORY: Advanced Development

DESCRIPTION: Many efforts are underway to develop Software Engineering Environments (SEEs) which will increase software productivity and product quality for real time combat systems. Many of these projects are directed towards development of new products in only one language (e.g. Ada). To be truly useful, a SEE must provide support for existing applications in addition to new applications. The support requirement for existing applications means that the integrated environments and tools must be capable of supporting a number of languages and language types. The goal of this effort is to determine the impact of this multi-lingual support requirement on the structure and architecture of a SEE and describe candidate SEE architecture. A range of languages from those in current use, such as CMS-2, to those projected for future combat system use, such as LISP, Prolog, etc., should be considered.

N88-107 TITLE: Mass Memory Technology

CATEGORY: Advanced Development

DESCRIPTION: A requirement exists for a survey of existing and projected mass memory technology through 1995. Include recommendations regarding future mass memory improvements to AN/SQQ-89 Surface Ship ASW Combat System. Areas to be improved over existing UYH-3 disk technology include cost, volume, weight, memory capacity, read/write time, seek and latency minimization, and multicomputer access. The need for faster access time, complicated by multiple computers sharing the mass memory, is a critical issue. Mass memory (traditionally disk) can be a bottleneck for initial program loads and display building. Future surface ship improvements will involve multiple algorithm processing of the same basic raw data, thus multiple reads of large data bases will become more common. Included in this survey and analysis of mass memory technology should be a feasibility study of using large quantities of random access memory as a "disk-like" function (sometimes referred to as "RAM Disk"). The feasibility study should include cost, reliability, and speed tradeoffs for data which can be stored in volatile memory.

N88-108 TITLE: Model For Missile Aerodynamic Forces At High Angles Of Attack

CATEGORY: Exploratory Development

DESCRIPTION: Presently, there is no adequate model available to predict water action and subsequent aerodynamic forces on missiles that fly at a high-angle-of-attack. Therefore, the Phase I effort should include: (a) Review of current literature on the subject; (b) Review current and government supplied wind tunnel data; (c) Developing a model for Body Vortex Shedding at high-angle-of-attack and tracking based on wind tunnel data; and (d) Verify model and update as required by comparing prediction with actual aerodynamic flight data (government will supply data).

N88-109 TITLE: Application of Image Enhancement Techniques To Minehunting Sonar

CATEGORY: Advanced Development

DESCRIPTION: The production of high resolution images from space based remote sensing platforms usually involves image enhancement techniques. These techniques involve algorithms that sharpen the boundaries of objects, and increase the contrast between objects and the background. Some techniques also involve pattern recognition routines. The results of this processing are images that appear, from a visual interpretation standpoint, to have been made with a higher resolution system. Experience has shown the value of increasingly higher spatial resolution in acoustical classification of mine sized targets. Several practical factors limit the achievable resolution. Higher resolution generally implies higher frequencies (reducing operating ranges), larger soundhead apertures (configuration impact on platforms) and higher fabrication accuracies (higher cost). If these image enhancement techniques are applicable to acoustic classification, the apparent resolution of existing systems could be improved, and additional options on sonar soundhead and systems design would be available in the future. This effort shall involve the identification and review of pertinent documents from space based remote sensing efforts. This information shall then be assessed as to its applicability to sonar classification of underwater objects. This assessment should involve addressing the following questions: (1) Are the available image enhancement algorithms directly applicable to multi-beam sonar imaging?, (2) Do these techniques operate in real time at typical sonar information rates?, (3) What options exist for the processed image output medium?, and (4) What is the computer capacity required for implementation of usable techniques with a state-of-the-art Mine Countermeasure (MCM) classification sonar?

N88-110 TITLE: Application of Artificial Intelligence To Combat Systems Employment

CATEGORY: Advanced Development

DESCRIPTION: A requirement exists to develop and demonstrate an approach for the application of artificial intelligence or expert system technology to Undersea Warfare (USW) Acoustic Performance Prediction (APP) suite employment and tactical decision aid products.

N88-111 TITLE: Low Cost, Low Weight Telemetry Concepts For Large Area Arrays

CATEGORY: Advanced Development

DESCRIPTION: In the future there is a distinct possibility of mounting very large arrays on submarines or surface ships. One of the major problems is getting the output of several thousand or tens of thousands of elements into the ship from the array. This is particularly difficult on a submarine because of high pressure effects. This task is to address possible telemetry concepts that can bring these signals into the ship with a minimum impact on the hull. These concepts should address weight, volume, vulnerability, reliability, and cost. A subsequent task should be to demonstrate the feasibility of the concepts.

N88-112 TITLE: Acoustic Properties Of Materials Suitable For Torpedo Nose Window

CATEGORY: Advanced Development

DESCRIPTION: The nose section of a torpedo is covered with a thick material that allows passage of acoustic signals and withstands operating pressures of water without distortion. The window material must have properties which match the density of water, have low acoustic energy absorption and do not conduct hull born noise to the nose section acoustic sensors. The contractor must show capability of obtaining and evaluating materials suitable for above usage. Properties necessary to quantify the requirements must be determined by the contractor in consultation with the Navy.

N88-113 TITLE: Electronic Replacements For AN/BQQ-5 Front End Transmit And Receive Sub-Assemblies

CATEGORY: Engineering Development

DESCRIPTION: The AN/BQQ-5 is configured with mechanical transmit and receive Sub-Assemblies. These mechanical devices require Intermediate or Depot level maintenance and are unreliable. The AN/BQQ-5 Receive Sub-Assembly uses two mechanical scanning/compensator switches. This project will study the feasibility of replacing the AN/BQQ-5 scanners/compensators with state of the art Standard Electronic Module (SEM) oriented Electronic Rotating Scanning Switches (ERSCAN). The AN/BQQ-5 transmit Sub-Assembly uses three mechanical transmit switches. The purpose of this project is to conduct a feasibility investigation for the development of a state-of-the-art transmit Sub-Assembly that would substantially improve reliability and be maintained at an Organizational level. Current sonar systems that are successfully configured with ERSCAN, are AN/SQS-53B, AN/BQS-14, AN/SQS-26CX, AN/BQR-7, AN/SQS-35/38 and AN/SQS-23 LORA.

N88-114 TITLE: Explosive Forming/Bonding Of Torpedo Hulls

CATEGORY: Exploratory Development

DESCRIPTION: Although torpedo shells are smooth on the outside, the inside requires considerable machining at a high cost. This task is to develop methods of using explosive techniques to manufacture torpedo shells. Methods may include explosive forming of entire shells or explosive bonding of various separately machined parts. Shell materials (aluminum) must be capable of withstanding water pressure to a specified depth and be highly resistive to corrosion. Approximate dimensions for shell sections are 21" or 12 ¾" diameter by 36" long.

N88-115 TITLE: Continuous Transmission Sonar

CATEGORY: Advanced Development

DESCRIPTION: A requirement exists for the development of a Continuous Frequency Modulation (CFM) transmission sonar for application as a low frequency (less than 2000Hz) echo ranging sonar system. The initial Phase I effort should be directed at determining the feasibility of hardware and software to demonstrate the continuous FM (CFM) mode.

N88-116 TITLE: Quiet Speed Reducer

CATEGORY: Exploratory Development

DESCRIPTION: Present torpedo gear reducers produce noise from the meshing of the individual gear teeth. There are a number of methods under investigation to reduce the noise from conventional gear boxes. This investigation will look for new ideas for torpedo speed reducers. The concept and explanation of testing to prove the concept must be included in the proposal. The proposed concept must have the potential of transmitting a thousand horsepower, fit within a 21 inch torpedo shell and have a speed reduction ratio of 150 to 1.

N88-117 TITLE: Optical Disk Storage Of Environmental Data Bases

CATEGORY: Advanced Development

DESCRIPTION: A requirement exists for developing and demonstrating an advanced development model (ADM) for the storage, retrieval and display of a large geographically oriented, environmental data base using the Navy standard Tactical Desktop Computer (HP-9020) and an optical disk. The following data bases will be supplied by the Navy shall be used: (a) Bathymetry; (b) Historical Temperature and salinity profiles; (c) High Frequency Bottom loss; (d) Low Frequency Bottom loss; (e) Volume scattering strength; (f) Ambient noise; and (g) Wind speed. The ADM should demonstrate an efficient, rapid and cost effective storage, retrieval and display technique.

N88-118 TITLE: Three Dimensional ASW Performance Prediction

CATEGORY: Advanced Development

DESCRIPTION: The Phase I effort shall be directed towards developing methods for the efficient application of range dependent modeling to produce three dimensional (i.e., range, azimuth, and depth dependent) performance prediction. These methods will include the optimum selection of radials and depths for propagation loss computations. The sensitivity of these predictions to the radial and depth selection methodology and search plan development shall be tested.

N88-119 TITLE: New Design For AN/BQH-1/TR-321 Transducer

CATEGORY: Engineering Development

DESCRIPTION: The AN/BQH-1/TR-321 is used on submarines to measure acoustic sound velocity (Vo). The sensing device, TR-321, exhibits instability at temperatures between 32°-40° C. The apparent source of the problem is older vintage transistors. This problem has been addressed with numerous fixes since 1950, and the problem still exists. The objective of this project is to study the feasibility of providing a long term fix using an off-the-shelf MIL-STD digital device easily interfaced with the TR-321 transducer. Additional improvements shall include the reduction of self (alerting) signals/noise and a significant reduction in false resets, which is presently exhibited in the reported "instability" above.

N88-120 TITLE: Technology For Making Underwater Connectors Resistant To Cathodic Delamination

CATEGORY: Engineering Development

DESCRIPTION: Most outboard sonar hardware uses connectors to transmit signals through the hull. The standard Navy connectors for underwater use are the metal shelled MIL-C-24231. It has been documented that metal shelled connectors that rely on rubber-to-metal bond for watertight integrity have a life expectancy of 1.5 to 2.5 years because of bond degradation due to cathodic delamination. A solution that is being implemented is to use a non-metallic connector back shell. Non-metallic Portsmouth connectors are being made by connector manufacturers to a Navy design for laboratory and Fleet testing. At the conclusion of the program a new non-metallic connector specification will result, however, the technology for manufacturing connectors to the specification will remain with the participating vendors. It is in the Navy's interest to obtain the technology for manufacturing non-metallic underwater connectors. The Navy must be able to rapidly and economically expand the application of non-metallic connectors to other systems as well as make connectors at shipyards or vendors. To do this, the Navy must understand how to make the connectors which requires special tooling, equipment and molding techniques not covered in a connector specification. The objective of this project is to develop manufacturing technology for making non-metallic underwater connectors so that the technology can be transferred to Navy facilities, contribute

to additional connector designs and be supplied to vendors as may be required to insure competitive connector prices.

N88-121 TITLE: Transducer Seal Testing

CATEGORY: Engineering Development

DESCRIPTION: Transducer seals are subjected the environmental and operational conditions not typically addressed by standard engineering practice. Furthermore, the seals are expected to remain functional for extended periods (5 to 15 years) with an extremely high reliability. Standard test procedures and equipment should be developed to address the accelerated life testing of these seals and sealing systems. The first phase of this effort should review the utilization of seals in transducers by type and function, and should address the design of appropriate accelerated test procedures and equipment. The secondary phase should include the completion of the detailed design of the equipment, construct prototype testing systems, and establish an integrated testing service for transducer seals.

N88-122 TITLE: Redesign Analog Technique For Bearing Determination In Harbor Acoustic Conditions

CATEGORY: Engineering Development

DESCRIPTION: There is a need for harbor defense personnel to become more capable in tracking potential threats. At present, this task is accomplished by using non-directional sensors such as sonobuoys. The problem is that actual target track and bearing are based upon the information from each of these sonobuoys taken one at a time; thus, the accuracy of these tracks are but gross estimates of actual tracks. The older Cross Correlating Detection and Ranging (CODAR) airborne systems such as the AN/AQA-3/4 used input from two sonobuoys (whose positions were known) which were fed into the system for bearing resolution via cross correlating each with the other. At this time, no such system exists for use. The system to be developed will be a modern version of this older system (circa 1953); which quantified each of the two signals from a pair of sonobuoys whose positions are very well known; cross correlates these two signals and processes the estimated bearings of all targets being detected to the host controller-desk top. After amassing a number of such estimates from yet even greater pairs of sonobuoys within a net – such as a harbor, actual estimates of all targets' tracks may be either displayed or reported to a larger host for display. The objective is a system that can be developed using off-the-shelf commercial hardware at a low cost and yet maintain the flexibility needed for close boundary acoustic signal processors for varying harbor-to-harbor conditions.

N88-123 TITLE: Investigate Own Transmission Cancellation For Continuous Frequency Modulation Sonars

CATEGORY: Advanced Development

DESCRIPTION: Sonar transmissions are usually confined to short pulses of about a second or less. As sonar ranges are extended, the time between transmissions may be tens of minutes. This is problematic since the total energy is constrained which requires very high peak powers during the transmission. Of greater concern is the very slow rate of target information arrival, providing only one target sample per transmission. The use of a continuous frequency modulation (CFM) transmission with modest peak-powers could provide good range and continuous target information flow. This CFM sonar will facilitate low frequency transmissions for long detection ranges. A primary problem with CFM sonars is some method of controlling the receiver so it remains linear or has a high instantaneous dynamic range even when close to the continuous transmissions. Since the anticipated received power from the transmissions far exceeds present receiver technology, this study will address methods of canceling the very powerful transmissions sufficient to allow reception of the very small echoes expected from long ranges. The cancellations are expected to consist of transmission-bucking circuitry and adaptive cancellers. The study will apply these techniques and investigate the degree to which operational equipment can achieve cancellations. It will simultaneously investigate extending the dynamic range of receivers or their tolerance to large signals while remaining linear. The output of this effort will be a prototype demonstration in a laboratory environment.

N88-124 TITLE: Multi Track Optical Disk Radar Video Recorder

CATEGORY: Engineering Development

DESCRIPTION: The AN/USH-24 is a bulky 14 track reel-to-reel tape machine capable of record and playback of wideband signals. It is used throughout DOD in radar, sonar, electronic warfare, and test instrumentation applications. A requirement exists for a replacement of the AN/USH-24 using optical disk technology that will be considerably smaller in size, be easier to handle and have more compact storage media, have wider bandwidth channels and increased record time. There is a need to identify candidate off-the-shelf optical disk read/write equipment, appropriate video multiplexer techniques to achieve the desired multiple track capability, and interface control logic for remote control operation. The components should then be procured and integrated into a total system. The end product would be a hardware deliverable suitable for comparative testing with the AN/USH-24.

N88-125 TITLE: Computerized Requirements For Expediting RFP Actions And Contract Documentation

CATEGORY: Management & Support

DESCRIPTION: A requirement exists to develop a standard computerized (P.C. – LOTUS 1, 2, 3) program designed to expedite RFP preparation/changes and maintaining life-of-contract waivers/deviations. This effort should include: (a) Standard contract clauses, reviewed and tailored with a view toward cost; (b) Standard Statement of Work (SOW) & Specification inputs designed to meet NAVSEA requirements but limiting Contract Data Requirements List (CDRL) items and geared toward EW system maintenance & missions; and (c) A readily available visual presentation (“tree”) of contract clauses, specs/standards required with waivers/deviations or tailoring noted, -- relative to any individual program – to facilitate contractor response, initial changes and establish documented corporate memory for government program or contract managers.

N88-126 TITLE: Application Of Micro-ADP To Ship Configuration Data Management

CATEGORY: Engineering Development

DESCRIPTION: A requirement exists for the application of state-of-the-art micro-automated data processing (ADP) to support configuration data management responsibilities of NAVSEA Technical Specification 9090-700. This would include such tasks as development of automated shipboard validation tools and procedures, use of micro-ADP to interface with other remote databases, application of state-of-the-art micro-data storage peripherals (CD ROM, WORM drives, etc.) to be able to locally access and process large data bases utilizing micro computers.

N88-127 TITLE: Provisioning/Supply Support Requirements Under Computer Aided Logistics Support

CATEGORY: Management & Support

DESCRIPTION: The DOD initiative on Computer Aided Logistics Support (CALS) will have radical impact on supply support including the design to the support process and will require assessment and development of new integrated supply strategies in support of fleet readiness. To date, supply planning involvement in this area has been minimal. Efforts to be undertaken include investigation of current CALS status, review of existing supply/provisioning policies and procedures, particularly as related to the Logistics Support Analysis (LSA) process, and proposed alternatives and recommendations for transitioning Navy supply practices to CALS.

N88-128 TITLE: Robotics Impact On Shipboard Manning

CATEGORY: Management & Support

DESCRIPTION: The well-established, current ship manning development process comprehensively factors-in operational, maintenance, life support, housekeeping, damage control, and ship administration manning considerations, using design work study techniques to optimize manning of ships. The prospective introduction of robotics and intelligent machine system adds new dimensions to the manning requirements determination process and raises a serious question as to whether the current model can handle the complex interrelationships that result when applications are automated or partially automated. While these generally reduce the amount of manpower required for the application function, the reduction may be more apparent than real if considered without the impact that such automation has elsewhere (as in watch standing, maintenance, housekeeping, life support, damage control, and administration). Given the inherent cultural bias favoring man over machine in most applications and the tendency to require a manual override capability for virtually all applications, the Navy has a need to develop a methodology for an objective application-by-application analysis of the impact of robotics on the structure and function of billets and manning on a total ship basis.

The contractor is asked to submit a proposal to develop such a methodology from a study of how manpower is used aboard ships. This study should include routine manpower-intensive operations, the peak manpower-intensive operations, and the special and singular requirements for damage control and corrective and periodic maintenance, with such determinations to reflect separately, normal steaming, Condition III, and General Quarters requirements. In developing this methodology, the contractor should keep in mind its intended uses: (a) To identify those areas that offer the best opportunities for reducing manning levels through robotics and automation; (b) TO assist in prioritizing specific application efforts; (c) To ensure that manpower economies are achieved through automation , but are not taken until a balanced, objective analysis is made of the impact of such a reduction on all other manpower requirements; and (d) To serve as a basis for the development of a universal model for continuing use in the application/technology matching process that is the key feature of the NAVSEA Integrated Robotic Program approach for developing robotics technology.

N88-129 TITLE: Fiber Optic Integrated Circuit Technology In Electronic Warfare Systems

CATEGORY: Advanced Development

DESCRIPTION: Opto-electronics technology is directed toward combining fiber optic sources, detectors, and active electronics devices on single chips embedded within equipment. Successful application of the technology to the requirements of high-performance shipboard sensor systems has the potential to reduce system complexity, increase data transfer and processing speeds, effect space and weight reductions, and improve system survivability. Innovative technical approaches to the design and fabrication of interconnected optical and electronic devices as a precursor to the demonstration (in Phase II) of an advanced representative shipboard system are required.

N88-130 TITLE: Advanced Information Display Techniques

CATEGORY: Engineering Development

DESCRIPTION: Large computer memories, sophisticated sensor systems, and high speed computing capabilities have created opportunities for greater utilization of the information resident in shipboard data bases. New and innovative methods are required by which to process such information and display it in "what-if" formats as an aid to rapid decision making in time-critical combat situations. Alternative designs for software programs compatible with Navy standard computers and displays which feature advanced data base design techniques and expert system techniques are desired.

N88-131 TITLE: Local Area Network Evaluation

CATEGORY: Exploratory Development

DESCRIPTION: A need exists to apply available Local Area Network (LAN) technology to shipboard tactical systems. Various LAN architectures and protocols have been proposed by industry for application to Navy requirements. The evaluation of competing LAN approaches across any reasonable number of application areas is cost-prohibitive. A need exists for innovative, low-cost methodologies by which to assess LAN performance in various applications and to define the associated technical issues. Typical issues include performance in a time-critical tactical system, impact of topology and interfaces on operating systems and tactical software, and data loading as a function of system application.

N88-132 TITLE: Battleforce Architecture Study

CATEGORY: Advanced Development

DESCRIPTION: Based on the "Force Fusion System Operational Concept Document," the "CV-IC Functional Requirement Report" and the "LHA-IC Functional Requirements Analysis," develop a computer hardware architecture and software system architecture that will support these requirements. The study should be divided into two parts. Part 1 should address the architecture assuming no constraints; i.e., specific hardware and software is not preordained. The architecture should though, be based on existing commercial and/or militarized products or products that will be available and fully tested by January 1988. Part 2 should address the architecture given that it must meet shipboard militarized requirements, the hardware is currently in the Navy inventory (or will be by 1989) and the software is a Navy approved product or will be by 1989. Emphasis should be placed on the main computers, interfaces and man-machine devices as well as the operating system software and data base management software.

N88-133 TITLE: Performance Evaluation Model For Naval Intelligence Processing System

CATEGORY: Engineering Development

DESCRIPTION: Develop or find a PC-based or VAX-based modeling program to depict the Naval Intelligence Processing System (NIPS) software system. The model needs to be capable of evaluating performance of the software in terms of time and complexity and of assessing the impact to the software system of new requirements (especially new interfaces, different data bases, use of different programming languages, etc.). The NPIS system is a multi-computer configuration that collects, processes, and reports intelligence data aboard a carrier. It is primarily a data base processing system.

N88-134 TITLE: Automated Testing Of Large Data Base Management Systems

CATEGORY: Engineering Development

DESCRIPTION: A requirement exists for automated benchmark and performance testing of large Data Base Management Systems (DBMS) in support of tactical systems for 1990-2000. The volumes of data available and the ability to provide data to the fleet user has increased. The ability of the tactical systems to process that volume of data in support of the Warfare Commander is becoming mission critical. Automated testing to assure that measures of performance are met will assist in the design, development, and fielding of future systems. Develop a methodology for automated testing and research available testing tools in the industry.

N88-135 TITLE: New Energy Sources For Conventional Warheads

CATEGORY: Research

DESCRIPTION: A need exists to find new conventional sources of energy which have the potential for significantly outperforming chemical explosives. One possibility is the formation of high density metastable phases of certain elements, which upon returning to their normal state, rapidly release vast quantities of energy. Novel

energy concepts such as the above need to be identified and evaluated as to their feasibility to accelerate warhead fragments.

N88-136 TITLE: Operational Concept For A Charged Particle Beam Weapon System

CATEGORY: Exploratory Development

DESCRIPTION: In the event the Navy builds a Charged Particle Beam Weapon System (CPBWS), the impact due to battle management could be significant. These impacts could modify the CPBWS design criteria. It would be prudent at an early stage to develop a top level operational concept for a CPBWS for one ship and for a battle group. Some issues that need to be addressed include: optimal number of gun directors; radiation effects to own ship; battle group disposition; radiation effects to friendly systems; required range; and effects on communications.

N88-137 TITLE: Artificial Intelligence Based Object Recognition System

CATEGORY: Advanced Development

DESCRIPTION: One of the key components of an autonomous vehicle is an object recognition system. The system is intended to remove man from the process of target recognition and acquisition. The main goal of using Artificial Intelligence (AI) is first to increase the probability of detection of the existence of features or objects in the image data and then to increase the probability of identifying them. There is a need for near real-time object recognition systems that can make use of context, semantics, and problem domain knowledge in an AI framework to improve the performance of vision systems for an autonomous vehicle.

N88-138 TITLE: High Performance Optical Image Processor

CATEGORY: Exploratory Development

DESCRIPTION: Currently available image processors are limited by size, complexity, speed and power requirements of conventional digital computers. Image understanding systems are required to perform target detection, location, and classification in real time through the use of optical elements that manipulate signals, images, and other target information. Concepts employing optical sensing, holographic correlation, image enhancement, feature extraction, multisensor fusion and similar optical techniques will be considered.

N88-139 TITLE: High Speed Image Processing Functions

CATEGORY: Advanced Development

DESCRIPTION: Develop real time image processing functions (e.g., edge detection, edge enhancement, averaging, etc.) based on the new generation of high speed LSI, VHSIC devices. The concept should be capable of insertion in a video or data stream defined by standard communication protocols and operate independently. The higher level systems ideally will be given the capability to dynamically adjust parameters. Defaults will be set on the functional module. The function is designed to download image processing functions and computational load from the main system, be focused on a specific algorithm, and be inexpensive both in cost and system overhead requirements.

N88-140 TITLE: Computer Architecture For Reduced Software Designs

CATEGORY: Advanced Development

DESCRIPTION: The cost of writing and maintaining computer software for military weapon systems can far exceed that of the hardware on which it runs. Innovative new computer architecture concepts are required that

reduce or eliminate the current dependence on costly and complicated operating systems and high level language software. These concepts should lead to the development of highly interactive user-friendly machines for use in a variety of military applications without the need for custom software or programming expertise.

N88-141 TITLE: Infrared Detector System

CATEGORY: Advanced Development

DESCRIPTION: The Navy has made significant progress in the development of a new instrumentation system for quantifying the degree of ordnance systems susceptibility to electromagnetic radiation. However, the developmental efforts have been hampered because of the non-availability of suitable Infrared (IR) detectors. The system under development utilizes optical fibers that transmit energy in the IR spectrum. Research on fibers conducted to date has demonstrated that conventional optical detector designs and configurations are unsuited for Hazards of Electromagnetic Radiation to Ordnance (HERO) instrumentation applications, because of the extremely low signal levels presented to the detector via the IR fiber. Further work is required to develop and evaluate new detector compositions and configurations, to develop fabrication techniques to minimize IR fiber coupling losses, and to maximize IR fiber collection efficiency. An IR detector system utilizing IR optical fibers will provide for a superior instrumentation system that can result in significant cost savings in the conduct of HERO testing.

N88-142 TITLE: Method To Detect And Track Charged Particle Beams

CATEGORY: Exploratory Development

DESCRIPTION: During the past decade the Navy has been investigating the potential of Charged Particle Beams (CPBs) for anti-ship missile defense. The objective of this task is to develop a method for accurately detecting and tracking the trajectory of an electron beam as it propagates toward its target since this will be one of the key elements in any future CPB fire control system. The beam track may be determined by either active or passive methods; however, the technique is required to work under poor visibility conditions. In addition, the method must be capable of collecting sufficient information from a single bolt so that the exact beam trajectory can be defined. All required sensors and active components should be located on the CPB host ship, and the time to collect and process the beam tracking data must be such that fast moving targets will not change positions.

N88-143 TITLE: Battle Force/Combat Systems Design Workstation

CATEGORY: Advanced Development

DESCRIPTION: Demonstrate a cost-effective, working prototype workstation for describing battle force, combat system, and major subsystem functional relationships using graphical forms while capturing the information in a form that permits further indirect analysis by following relation chains. Such a workstation should permit describing either battle force entities, combat system entities, or major subsystem entities. The workstation should permit design to be approached from either a data flow or control flow viewpoint as the user might prefer. Key features would include a variety of graphical (input and output) forms, underlying data base with open architecture (for interfacing additional tools), and static analyzers.

N88-144 TITLE: Acoustic-Elastic Wave Velocities in Metal-Matrix Composites

CATEGORY: Exploratory Development

DESCRIPTION: Unidirectional and laminated metal matrix composites often have high residual stresses after processing. Quantitative estimates of such stresses obtained by measuring changes in acousto-elastic wave velocities will be helpful in the design of structural components. Analytical model and data correlation studies are required for obtaining reliable estimates of these stresses. The model should be based on micromechanics and third

order elastic constants of the constituents and an accurate solution of appropriate boundary value problems. It will be especially helpful for obtaining better estimates of transverse velocities than what is obtained by rule-of-mixture type solutions.

N88-145 TITLE: Properties Investigation Of Advanced Intermetallic Compounds

CATEGORY: Research

DESCRIPTION: Advanced airbreathing and impulsive propulsion systems can demonstrate significant performance improvement over current systems through operation at higher temperatures and/or use of more energetic fuels. Higher operating temperatures and/or more energetic fuels require materials with greater thermal and chemical stability. Intermetallic compounds offer potential for use in high temperature, oxidation-resistant material systems through use as oxygen or carbon barriers. Intermetallics useful to 5000° F are desired and suggested systems include rhenium compounds (Re + Hf, Re + W) and iridium compounds (Ir + Re, Ir + Os). Potential applications include coating systems for carbon-carbon and interface barrier layers for systems such as carbon-hafnium diboride composites. The need currently exists for carbon diffusion and oxidation data for advanced intermetallic systems. Additionally, consideration should be given toward their utilization and demonstration into new material concepts.

N88-146 TITLE: Impact Damage Characterization Of Carbon-Carbon Satellite Materials

CATEGORY: Exploratory Development

DESCRIPTION: The purpose of this study is to investigate techniques which could be developed and then utilized to ascertain the extent of damage sustained by carbon-carbon satellite materials when hit with a particle or kinetic energy weapon. This data could then be applied to an accept-reject criteria for damaged structures. Main emphasis is to be on thin (10-50 mils) structural materials such as tubes and plates.

N88-147 TITLE: Protective Coatings For Carbon-Carbon Spacecraft Materials

CATEGORY: Exploratory Development

DESCRIPTION: A need exists to develop protective coatings for thin (10-50 mils) carbon-carbon (C-C) materials used on satellites located in Low Earth Orbit (LEO). In the LEO environment, atomic oxygen attack is a severe problem as it degrades C-C properties. Another concern is the protection against thermal excursions to 4000° F due to a laser or nuclear attack. A coating system that addresses both of these issues is sought.

N88-148 TITLE: Expert Assistant For Structured Software Development

CATEGORY: Advanced Development

DESCRIPTION: Computer Aided Software Engineering (CASE) tools are becoming available which support the structured analysis and design methods used to develop software for embedded, real time systems. It would appear that such tools could benefit from the application of Expert Systems Technology. The purpose of this task is to explore the use of expert systems for supporting the structured methods. These methods are characterized by models (and the subsequent analysis of them) which capture views of the processes, data, real time characteristics, and the module hierarchy. Efforts should be directed toward the development of an "Intelligent Expert Assistant" which would allow CASE tools to be more effectively used for software development. The Assistant would help assure that the products resulting from the use of CASE tools are of high quality and conform to "standards and guidelines" as supplied by the developers.

N88-149 TITLE: Long Haul Fiber Optic Link For Navy Ranges

CATEGORY: Advanced Development

DESCRIPTION: Long haul, point-to-point fiber optic communication is being applied to various data gathering needs. A prototype fiber optic link is needed to provide a one way data path for remote in-water data gathering. Under this project, present multi-conductor and coax communication systems used by the Naval Surface Weapons Center will be briefly studied, then one or more fiber optic based communications systems will be designed as a means of improving the system performance in a cost effective manner. Performance versus cost standards will be established. These performance standards will specifically include or take into account: 1) Delivery of power to the in-water unit using the present cable and/or using metal conductors in the proposed fiber cable; 2) The type of cable and the physical termination of the link on-shore and in-water; 3) Data rates from .5 mbits/sec. per unit to 10 mbits/sec. per unit; 4) The data link length varying from 300 meters to 10 Kilometers (with no repeaters) and water depths to 200 meters (typically 40 meters); 5) Ruggedness of the link with respect to the exposure to sea life for periods of 3-5 years; 6) The possibility of multiple units closely spaced feeding a single link; 7) The use of a single mode single fiber laser driven system vs. multiple fiber LED driven system; and 8) The connection to the link in-water to be accomplished via multiple standard synchronous or asynchronous interfaces (e.g. multiple STD-bus single board computers with RS-422 outputs). The model (s) developed will permit specific features to be studied in detail. A small non-rugged prototype will be built and tested. The Phase II effort would involve full scale prototyping and testing.

N88-150 TITLE: Novel Approaches To The Synthesis Of Fluorodinitromethane And Fluorodinitroethanol

CATEGORY: Exploratory Development

DESCRIPTION: A number of compounds containing the fluorodinitromethyl group are used as energetic plasticizers and polymers in high performance explosive conditions. The use of these materials is restricted by their high cost. Increased benefits from the high energy content and excellent stability of these materials could be realized for a wider range of Navy munitions if their cost could be reduced. For these reasons, novel synthesis methods for the key precursors, fluorodinitromethane and 2,2,2 fluorodinitroethanol, are sought which are not based on nitroform or 2,2-dinitropropanol as starting materials. Alternatively, the novel methods may derive from nitroform or 2,2-dinitropropanol if improved production methods for these two materials are being proposed also as an integral part of the project.

N88-151 TITLE: Improving The Efficiency Of The Reaction Of Aluminum In Explosives

CATEGORY: Exploratory Development

DESCRIPTION: The use of aluminum in explosives offers a very high calculated performance (>400 kbars detonation pressure). This improvement, however, has not been realized as current aluminized explosives deliver approximately 90% of the calculated performance. That the aluminum is reacting too slowly is plainly shown in the results of the cylinder tests, where the cylinder energy is continuing to increase at the higher expansions of the copper cylinder. The goal of this effort is to alter the surface characteristics of the aluminum particles by physical or chemical means to improve the efficiency of the reaction. This improvement must be demonstrated by measuring the detonation pressure or the cylinder energy of the aluminized explosive.

N88-152 TITLE: Reactive Coatings On Metal Fuels

CATEGORY: Exploratory Development

DESCRIPTION: A need exists for effectively coating metals for efficient combustion in propellants and explosives. A coating of magnesium (one micron thickness or less) on boron particles is desired by any one of the following methods of controlled metal deposition; vapor, electrochemical, ion or organometallic techniques. Also, the

feasibility of coating aluminum particles via micro-encapsulation techniques with nitro cellulose (one micron thickness or less) should be evaluated with respect to coating integrity, shell wall thickness, loading ratio and flow.

N88-153 TITLE: Shear Rate Determination For Twin Screw Continuous PBX Processing

CATEGORY: Exploratory Development

DESCRIPTION: Development of twin screw processing technology for continuous production of thermoplastic elastomeric Plastic Bonded Explosives (PBXS) is hampered by the absence of a method to accurately measure shear rates that an energetic composition experiences in the mixing operation. In twin screw continuous processing, a small quantity of material is intensively mixed for a few minutes. Accurate determination and control of processing parameters is necessary for heat and hear sensitive materials such as explosives. It is essential to have a simple, visual means to detect the shear rates to which material is exposed in order to avoid potentially hazardous temperature rises and energetic solid crystal shearing. Development of a simple, visual method to determine shear rate experienced in the twin screw continuous processor should be investigated in order to meet the needs for safe, cost-effective, high volume PBX production.

N88-154 TITLE: Fabrication of A High Strength Porous Aluminum Material

CATEGORY: Exploratory Development

DESCRIPTION: The need exists for porous Aluminum material that can be selectively produced in a density range of 1.35-2.70 grams/cc. This material must have a compressive yield strength exceeding 15,000 pounds per square inch, at 2% offset. If possible, a greater yield strength (i.e., 40-50 KSI) would be desired. It is acceptable for this material to be an alloy containing up to 25% elements other than aluminum. In addition, this material must be producible in cylindrical pieces as large as 20 inches in diameter by 60 inches in length.

N88-155 TITLE: Laser Initiation Of Insensitive High Explosives

CATEGORY: Advanced Development

DESCRIPTION: Most ordnance systems utilize either an electrical transmission from the power control source, or an explosive energy transmission line from a detonator-firing unit to the event. The electrical system requires well-shielded cables, and the ordnance must be able to survive high levels of radio frequency interference. Complicated out-of-line, safe-and-arm mechanisms are required for most systems. The explosive train has the disadvantages of being vulnerable to inadvertent initiation by very low energy and non-verifiability of the explosive column continuity. Laser initiation of insensitive explosive allows instantaneous detonation and precludes the need for shielding from all electrical hazards, and the need for conventional safe-and-arm mechanisms, since initiation depends on the optical power level of the laser source. The major goal of this effort is to fabricate insensitive detonators for insensitive and heat-resistant high explosives. A totally integrated laser ordnance initiation system that is simple, compact, reliable, verifiable and durable is desired that can efficiently initiate explosives such as TATB (1, 3, 5, triamino-2, 4, 6 –trinitrobenzene), DIPAN (dipicramide) and HNS (hexanitrotilbene).

N88-156 TITLE: Development Of An On-Line Rheometer Suitable For Twin Screw Extrusion Use

CATEGORY: Advanced Development

DESCRIPTION: There is a current emphasis on developing continuous methods of producing propellants and explosives with twin-screw extruders. Unfortunately, very little theological data exists on the extrusion of highly solid filled polymers. For this purpose, an on-line rheometer is needed to provide as close to real time data as possible. This effort should identify and develop a suitable device that can be placed on-line and be used for process control as well as data accumulation purposes.

N88-157 TITLE: Conducting Biopolymers

CATEGORY: Research

DESCRIPTION: It is desired to develop structural biopolymers which are electronically conducting; that is biopolymeric materials which conduct by other than ionic means. Such materials could serve as intrinsic structural elements, sealing materials, or matrices for composite materials.

N88-158 TITLE: Ceramic Superconducting Materials

CATEGORY: Exploratory Development

DESCRIPTION: Recent research in superconductivity has lead to reports of ceramic material superconductivity at temperatures of 100 to 230° K. These advances offer considerable promises for realistic application to naval weapons and space systems. To provide the greatest benefit to the Navy, these materials should be readily available, easily fabricated into useful configurations, be superconductive at temperatures approaching 115° K or higher, and exhibit no performance degradation in naval environments. The goal of this investigation is to identify materials or families of materials having potential to meet the Navy requirements, to establish initial feasibility through preliminary conductivity measurements, and to provide limited material for Navy verification (3 samples of each material; 10 mm in diameter by 3-4 mm high or 20 mm in diameter by 5-6 mm high). Letter progress reports (every 2 months) and a detailed final summary report (describing the materials, the selection methodology, the initial conductivity results, and a plan for Phase II research/validation) are required.

N88-159 TITLE: Mullite Felt Reinforced Ceramics

CATEGORY: Exploratory Development

DESCRIPTION: Develop a method of impregnating government furnished mullite felt ($3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$) with ceramic matrix materials to form reinforced ceramic composite samples. Potential matrix materials are silica, alumina, mullite, and other ceramics. Potential methods of impregnation are solgel, chemical vapor infiltration/deposition as well as other methods of ceramic material deposition. The contractor should also select and perform a series of mechanical and dielectric property tests aimed at evaluating the materials for tactical missile radome applications.

N88-160 TITLE: Reinforced Ceramics Injection Molding

CATEGORY: Advanced Development

DESCRIPTION: Perform experimental investigations on the injection molding of reinforced ceramic parts. Prepare starting materials, select reinforcements, and make a number of experimental configurations. Investigation will work out the details of molding cycles, binders, and mixing ratios. Assess the properties of the resulting composite parts.

N88-161 TITLE: Syntactic Foam Composites

CATEGORY: Advanced Development

DESCRIPTION: A need exists to develop high strength, rho-c (acoustic impedance), low cost, easily manufactured syntactic foam composites which contain either a random distribution or a three-dimensional array of regularly spaced inclusions or cavities. The inclusions may be rigid or soft, spherical or spherical shells or cubic or cylindrical, and may be various dimensions and densities.

N88-162 TITLE: Fast Triggering Devices

CATEGORY: Engineering Development

DESCRIPTION: Many electrical actuators which trigger within a millisecond of receiving their signal input are inductive, or non-quiet, or melt, or are explosive in their operation. Shape memory alloys, such as NITINOL, under the stimulus of resistance heating, can be free of these attributes and still perform triggering functions. Simple demonstrations have shown that they also exert considerable force during their shape recovery. The development of a new class of sensor/actuators with reset capabilities would be of both military and commercial value. Operating devices need to be constructed and tested for engineering data on their switching time, life cycle, and performance capabilities.

N88-163 TITLE: Technology For The Manufacture Of Complex Shape Space Structures

CATEGORY: Advanced Development

DESCRIPTION: The limited manufacturability of continuously reinforced graphite/metals into complex shapes has contributed to their lack of acceptance as space structural materials. Development at low-cost, innovative manufacturing concepts would eliminate the need for costly tooling and facilities, thus accelerating application of Gr/Al and Gr/Mg to critical Navy space structures. The technology to be demonstrated must be able to produce complex shape, variable thickness, graphite/metal components having high specific stiffness, low coefficient of thermal expansion and overall structural integrity, and be easily scalable. Proof of concept will be demonstrated via the delivery of a complex-shape, variable thickness graphite/metal part representative of a space structural component for laboratory evaluation.

N88-164 TITLE: Low Cost Sensitive Accelerometer

CATEGORY: Exploratory Development

DESCRIPTION: Field annealed iron-based metallic glass ribbons can be fabricated into strain gages with figures of merit (F) in excess of 2×10^5 ($F = (OMI0E)/\mu$, where M is the permeability). Such strain gages can serve as the basis of accelerometers which are as sensitive as the best currently available but at a substantially reduced cost. The goal of this effort is to produce a miniaturized accelerometer by deposition of all components directly onto a substrate. Particularly important is the development of an in-situ magnetic field annealing technique (for stress relief and appropriate magnetic anisotropy) of the sputtered amorphous film.

N88-165 TITLE: High Temperature Superconductors

CATEGORY: Exploratory Development

DESCRIPTION: In order to exploit the recent discovery of a family of La-Ba-Cu-O and similar compounds which exhibit superconductivity at high temperatures ($>> 50K$), it is necessary to devise fabrication methods capable of yielding fine wires. Since these new superconductors are not metallic or intermetallic, the conventional wire forming methods are not likely to be useful. Innovative methods must be developed to fabricate these compounds into forms which can be employed in making magnets and transformers. It is to be recalled that A15 superconductors also required ingenious metallurgical manipulations, e.g. the Bronze Process to overcome ductility limitations of Nb_3Sn , Nb_3G3 , V_3Ga and the like. Just as the Bronze Process was generic, and applied to many A15 superconductors, this topic is aimed at the development of techniques leading to low cost production of new oxide or ceramic superconductors of the La-Ba-C-O type high temperature superconductor family.

N88-166 TITLE: High Rate Rechargeable Li/SO₄ Cell

CATEGORY: Exploratory Development

DESCRIPTION: The Navy would like to develop a high rate rechargeable lithium battery. The goal of this effort is to determine what are the rate and cycle life limitations of a rechargeable Li/SO₄ cell. Examples of topics to be investigated should include: effect of carbon type, separator paper, and electrolytic salt. Investigations may be performed using experimental research cells or manufactured hermetic cells.

N88-167 TITLE: Lithium Cell Examination Using Fiber Optics

CATEGORY: Advanced Development

DESCRIPTION: The full utilization of lithium battery technology has been hampered by incipient safety problems. Approaches, essentially chemical and thermal in nature, have been tried to shed light on these techniques. However, others are still unresolved, preventing this advanced technology from being used on all Navy platforms. Recently, a fiber optic technique has been proposed which provides a tool for direct visual observation of the internal components of a lithium cell during storage, discharge, charging, and under hazardous abuse conditions. Though this concepts has thus far not been exploited, it has potential for identifying cell performance phenomena such as: reaction site discontinuities, anode coating, and coating breakdown, and hotspot initiation and propagation. The objective of this effort is therefore to develop a fiber optic technique for functional test in identifying lithium cell performance phenomena. A knowledge of lithium cell construction and safety test procedures will be necessary.

N88-168 TITLE: Atomic Imaging Display

CATEGORY: Engineering Development

DESCRIPTION: Application of the scanning tunneling microscope (STM) to Navy problems requires the development of computerized image display capability, including instrument control, data acquisition, data processing and interactive image display. Instrument control requires an x-y voltage roster in the 0-10v range and data acquisition requires measurement of currents with a dynamic range of 10⁻¹⁰ A to 10⁻³ A. Two modes of operation are required. In the real-time mode, repetitive x-y scans are to be made at video rates and the data recorded on a video tape recorder for video playback and/or image digitization and computer processing. In the high resolution mode, an x-y scan is to be made in a discrete point-by-point array. The image is to be recorded in this mode as digitized array. The display system must be able to digitally process data from both modes and display it as a high resolution color image with shadowing and three-dimensional rotation.

N88-169 TITLE: Analysis Of Microstructure And Geometry On Guided Elastic Waves

CATEGORY: Advanced Development

DESCRIPTION: Proposals are sought for the theoretical analysis of the propagation of guided elastic waves in anisotropic fiber reinforced composite plates. Dispersive effects due to the material microstructure and the geometry of the plate, as well as the difference between the direction of energy flow and the direction of the wave normal must be considered. The purpose of the analysis is to assist in the nondestructive testing of composite plates by ultrasonic waves launched from piston-like sources.

N88-170 TITLE: Laser Optical Detection OF Elastic Waves Propagating In Metallic Plates

CATEGORY: Exploratory Development

DESCRIPTION: Elastic waves (0.1 to 2 MHz) are used extensively for the characterization of composites. Non-contacting, laser detection of waves propagating in metallic composite plates using interferometric, heterodyning, or fiber optic techniques has shown promise in well controlled laboratory conditions. Proposals are sought to extend such techniques to the industrial environment. Considerations must be given to the effects of material surface conditions, bandwidth, and signal to noise problems associated with the non-ideal environment.

N88-171 TITLE: Compact Accelerators

CATEGORY: Exploratory Development

DESCRIPTION: Present-day high energy (>10 MeV), high current (kA's) linear accelerators are unsuitable for future tactical and strategic applications – the size and weight are well over the specifications of the available platforms. Innovative ideas and designs are needed to make the accelerators more compact. Research areas include accelerator designs, beam equilibrium and stability, beam injection and extraction and beam transport.

N88-172 TITLE: Development Of A Fast Neutron Detector

CATEGORY: Exploratory Development

DESCRIPTION: The Navy's radiation dosimetry program needs a fast neutron detector to measure neutron doses in a mixed neutron-gamma field. The proposed technique should be based on innovative concepts and should work well for a fast neutron peak at approximately 1 Mev. The desirable energy range for fast neutron detection extends from 30 kev to 14 Mev. The technique should be sensitive enough to discriminate a small fast neutron signal in the presence of a comparatively large gamma background.

N88-173 TITLE: Underwater RADIAC Instrument

CATEGORY: Advanced Development

DESCRIPTION: The Navy does not have portable self-contained equipment which can detect, measure, and analyze gamma and neutron radiation in the underwater environment. Equipment with these capabilities would be of great value in operations to recover nuclear materials which have entered the underwater environment accidentally or through hostile actions. The objective of this task is to develop an underwater RADIAC (Radiation-Detection-Indication and Computation) instrument having the following characteristics: an operating depth of at least 300 feet; size and weight that would permit operation by a single diver with no requirement for support from surface; the capability to distinguish gamma and neutron radiation and identify source materials; a warning system to alert the diver to hazardous radiation levels.

N88-174 TITLE: Infrared Spectral Signature Modification

CATEGORY: Exploratory Development

DESCRIPTION: Navy infrared decoys utilizing combustion processes often possess infrared (IR) signatures with undesirable spectral features. Signature optimization requires that these features be modified to replicate as well as possible, the weapon system they are designed to protect. A proposed program should identify the appropriate signature component sources and present a method by which they may be modified as required. A non-toxic chemical approach such as a fuel additive is preferred. Experimental verification of the methodology is required in Phase II.

N88-175 TITLE: Testbed For System Level Simulation

CATEGORY: Advanced Development

DESCRIPTION: The Department of Defense has an ever-growing need for efficient simulation of system designs of digital systems. It is conceivable that with the inexpensive, powerful micro-processors that are now available, an economical system simulator can be produced. The system simulator must be easily scalable in hardware resources and have a powerful development environment. An environment developed around UNIX is strongly recommended.

N88-176 TITLE: Underwater Data Acquisition System

CATEGORY: Advanced Development

DESCRIPTION: The Navy is interested in an Application Specific Integrated Circuit (ASIC) based Underwater Data Acquisition System to process data in the low frequency band, with up to 16 channels while consuming the absolute minimum power (less than 20 milliwatts), and using the smallest possible volume, (less than twelve cubic inches). Standard Digital Signal Processing (DSP) algorithms and math operations will be the intended software. Possible modules will include A/D converters, a microprocessor (s), RAM, ROM, WOM, hardware multiply, etc. CMOS is thought to be the best process, but respondents are not restricted. Technology shall be available to eventually meet most of MILSPEC 883 requirements. Supply voltage shall be low, preferably 3V, possibly 5V.

N88-177 TITLE: Algorithms For Interference Suppression In IR Search And Track Systems

CATEGORY: Exploratory Development

DESCRIPTION: In a typical IR Search and Track (IRST) system the raw video generated by the IR detectors undergoes signal processing culminating in threshold exceedances or post-detection data. These data may contain potential targets but are mostly due to interference (clutter or other noise). The interference distributions are of various types, generally nonstationary random processes. A systematic innovative approach is needed to process the post-detection data so as to achieve optimum target versus interference discrimination. The approach should exploit techniques engendered in general decision theory (hypothesis testing, non-parametric detection, markov processes, etc.), as well as multi-scan (look) correlation techniques. An optimum set of algorithms for IRST post-detection data should be the result of this effort.

N88-178 TITLE: Advanced Explosion Damage Model Development

CATEGORY: Exploratory Development

DESCRIPTION: A need exists for the development of advanced models for predicting the damage inflicted on targets by air and/or underwater weapons. The task requires that finite element codes and models be upgraded to treat the following topics: large dynamic plastic deformation; perforation; erosion of penetrators; spalling; crack growth; fluid-structure interaction; and propagation of strong shock and detonation waves through several media. Not only are new capabilities added to the codes, but basic improvements in the codes themselves are made. These include modular architecture; numerically stable interfacing between the modules; efficient integration; and user "friendly" pre- and post-processing.

N88-179 TITLE: Infrared Tracker

CATEGORY: Exploratory Development

DESCRIPTION: A need exists to utilize uncooled or Thermoelectrically (TE) cooled sensors for fire control trackers. The limited lifetime of current cooler systems and the long cooldown time restrict the use of infrared sensors in many naval applications. Some sacrifice in the performance of thermal imagers may be necessary to increase the availability of sensors. This proposed topic is therefore concerned with the preliminary design of an infrared tracking sensor system that uses uncooled or TE cooled detectors. Suggested applications for this technology include short range fire control systems and missile seekers.

N88-180 TITLE: Magnetic Acceleration Of Warhead Fragments To High Velocities

CATEGORY: Exploratory Development

DESCRIPTION: Because of high air target and interceptor closing velocities, the need exists to produce high-velocity warhead fragments to ensure hits on the target. It is difficult to produce fragment velocities beyond 8 or 9 Kft/sec using conventional warhead designs. One possibility is to use an explosive generator to produce a large current which is fed to the warhead fragments in the presence of a magnetic field. This concept may have the potential to produce hypervelocity warhead fragments. The concept is to be studied and its feasibility determined.

N88-181 TITLE: Adaptive Tactical Weapon System

CATEGORY: Advanced Development

DESCRIPTION: All of the Armed Services have a basic tactical requirement to engage and neutralize specific targets with a minimal expenditure of resources in all theatre environments without an unwarranted use of force, equipment, or personnel. An Adaptive Tactical Weapon System (ATWS) will incorporate the ability to discriminate a specific target based upon a target data imprint acquired from using the target itself as a pre-launch data source. The target imprint technique provides the potential for a "Fire and Forget Weapon" that does not require continuous target data update for either current or future threats. Inputs required for initiating advanced development for an ATWS include the identification of a sensor or combination of sensors (RF, IR, or optical) to adequately characterize the imprints of typical threats. In addition, a design concept must be defined for the storage of imprint data and the processing of the data to the in-flight control system.

N88-182 TITLE: Battle Damage Assessment For Anti-Ship Warfare

CATEGORY: Advanced Development

DESCRIPTION: The Navy has need for a battle damage assessment capability which can estimate the degree of damage inflicted on an individual enemy ship, or a group of ships, due to attack by air, surface, and/or submarine platforms. This capability should be able to use and interpret all types of real-time data from sensors such as radar, ESM, sonar, communications, etc., as well as stored intelligence data and other knowledge. A desired prototype capability would run on an IBM-PC/AT or HP-9020A, with the target application being embedded in a mainframe Command and Control system.

N88-183 TITLE: Safe-Ultra High Energy Density Lithium Battery

CATEGORY: Exploratory Development

DESCRIPTION: Lithium sulfuryl chloride has the potential for improving on the energy density of lithium/thionyl chloride electrochemical cells by a factor of two (volumetric). To achieve this potential will require the development of a catholyte (liquid cathode) combining chemical stability with reliable and controllable discharge performance. Electrolyte additives and catalysts should be derived based on known sulfuryl chloride chemistry to obtain performance and stability levels required in power sources acceptable for fleet use. Another objective will be

the identification of container materials inert to sulfuryl chloride on long term storage and during extended active life of cells and batteries.

N88-184 TITLE: Comparative Analysis Techniques For Interprocess Communication Design

CATEGORY: Exploratory Development

DESCRIPTION: Complex naval warfare systems with hard timing deadlines impose very demanding constraints on the Interprocess Communications (IPC) facilities at runtime. Current approaches to IPC are being stretched to the limit and beyond by new system architectures that are required to meet the threat. To permit the evolution of IPC facilities to support this requirement, techniques for comparative analysis of current and proposed IPC designs are needed. IPC performance is a system level concern. Therefore, comparative techniques must address all contextual attributed (e.g., software, computer and interconnection structures) of a surface Navy warfare system architecture.

N88-185 TITLE: Nuclear Radiation Detector

CATEGORY: Advanced Development

DESCRIPTION: One of the major barriers to the nuclear hardening of Navy systems is the availability of cost-effective general purpose hardening modules. A tactical nuclear environment consists of transient ionizing radiation, neutrons, and an accumulation of ionizing radiation or total dose. The electronic effects of transient ionizing radiation are latch-up, photocurrent burnout and transient upset. Neutrons cause transistor gain degradation and total dose causes Metal-Oxide-Semiconductor (MOS) threshold level shifts. Considerable system level protection against transient radiation can be accomplished with the addition of several basic electronic modules. They consist of a radiation detection and timing module, a fast power interrupt and power dump module, and a circumvention and recovery module with protected fully hard memory. Initial electronic circuits for the above three modules have been developed and breadboarded. Further development is required along with cost-effective hybridization to make these modules available to Navy contractors for test purposes and incorporation into new or existing Navy systems.

N88-186 TITLE: Robots For Hazardous Military Operations

CATEGORY: Advanced Development

DESCRIPTION: Robots have reduced costs, improved quality and increased safety in a variety of industrial tasks. There is a similar potential and need for the use of robots in hazardous or labor intensive Naval operations in the fleet, at depots, weapon stations, maintenance facilities and other shore stations. Such tasks as maintenance, repair, inspection, test, sentry duty, surveillance, and underwater salvage are typical jobs for autonomous and remotely controlled automation systems.

N88-187 TITLE: Surface Surveillance And Search Enhancements Using Prediction Of Enemy Tactics

CATEGORY: Advanced Development

DESCRIPTION: Hypothesis regarding enemy courses of action are an important aspect of warfare. Based on such assumptions, a commander might launch additional reconnaissance aircraft. The accuracy of the assumptions can weigh heavily in determining the ultimate outcome. The need is for a system which will: (1) generate problematic hypotheses based on information, such as current tactical data, current and archived intelligence information, and knowledge ("expertise") concerning enemy tactics, and (2) in combination with track data, generate improved search and surveillance plans weighted to account for impact of search results on own force actions.

N88-188 TITLE: Expert Systems For Airborne Computers

CATEGORY: Advanced Development

DESCRIPTION: Future weapon systems will utilize onboard artificial intelligence for combat decision support, target identification and other intelligent weapon tasks. Most current expert systems require extensive and very specialized computer resources to perform these functions. Compact and efficient expert systems that can be implemented on existing and planned military airborne computers are required.

N88-189 TITLE: Corrosion Behavior Of Metal Matrix Composites

CATEGORY: Exploratory Development

DESCRIPTION: Proposals are sought to determine the corrosion behavior of various metal matrix composites in hostile environments such as salt spray, seawater, stack gases, etc. Emphasis should be placed on determining the nature of the interface between the reinforcement and the matrix material. A better understanding of this interface is important to help elucidate the mechanisms of corrosion. The approach should include electrochemical and surface analytical techniques.

N88-190 TITLE: Thin Film Metal Matrix Composites

CATEGORY: Exploratory Development

DESCRIPTION: Thin films of metals alloy, ceramics and polymers are now routinely prepared via a variety of techniques. For the most part, these thin films are pertinent to electronic circuitry. Their mechanical properties have received little attention even though it is known that 400A^o thick film of Ni possesses upwards of 200 to 300 ksi strength as compared to 50 to 60 ksi for bulk nickel. There is also evidence that thin films grown epitaxially may exhibit higher modulus as well. Under proper conditions, it should be possible to devise metal/metal or metal/ceramic combinations to synthesize useful Metal Matrix Composites (MMC) thin film composites. The objective of this effort is to explore the viability of thin film composites in terms of materials selection and fabrication and to ascertain whether the high strength/high modulus combination can be exploited for structural applications.

N88-191 TITLE: Process Control For Production Of Highly Solid Filled Explosives

CATEGORY: Advanced Development

DESCRIPTION: Continuous processing of highly solid filled propellants and explosives via twin-screw extruders is of increasing interest to the Navy. For a practical production system, a process control system must be developed to monitor and control product quality. This effort should identify the important control variables and develop a control scheme including the types of required analytical instruments, control equipment and data accumulators as well as their placement on-line.

N88-192 TITLE: Underwater Signaling Devices

CATEGORY: Advanced Development

DESCRIPTION: A requirement exists for the design and fabrication of a prototype device capable of producing a series of acoustic pulses underwater to depths of 1500 feet. The device must have the following characteristics: (a) Pulse timing accurate within 50 milliseconds; (b) Pulse timing programmable and presetable; (c) Pulses generated during a period of not less than 4 nor more than 40 minutes; (d) Each pulse must have a source strength of 225 dB (Referenced to 1 micropascal); (e) Each pulse duration (3 dB points) must not exceed 250 milliseconds; (f) Device

must be self-contained and able to generate pulses at any preset depth from 100 to 1500 feet; and (g) Device (In any one delivery mode) must fit within a cylinder 6 inches in diameter and 40 inches long.

N88-193 TITLE: Naval Mine Batteries With Increased Reliability And Safety

CATEGORY: Advanced Development

DESCRIPTION: Current magnesium batteries used in naval mines, due to their aqueous technology, exhaust a hydrogen gas that permeates unsealed electronic components which can adversely affect their function. The use of lithium battery systems requires extensive safety and disposal qualification because of past safety problems such as explosive venting of cells with fire and shrapnel. This effort seeks to establish the feasibility and cost effectiveness of a non-lithium battery system which has comparable performance characteristics to lithium systems in areas such as system potential, energy density, capacity, and shelf life, but without the potential safety hazards and without the hydrogen gas exhaust present in aqueous magnesium batteries.

N88-194 TITLE: High Speed Optical Processing

CATEGORY: Exploratory Development

DESCRIPTION: To defeat the high performance air target of the future, sensors systems are required that can instantaneously process target information to provide missile guidance and warhead fuzing commands in a hypersonic engagement. Hybrid electronic/optical systems employing optical techniques to perform real-time processing and interpretation of sensory information at extremely high data rates are required.

N88-195 TITLE: Anti-Ship Targeting Using Tactics

CATEGORY: Advanced Development

DESCRIPTION: Techniques presently being used to predict enemy ship or battle group positions in the future, given a track history for targeting long range cruise missiles, are based on statistical and probabilistic formulations. That is, all possible responses are considered. Potential tactics that the enemy commander may actually employ in any given situation are not considered. For example, hypotheses regarding target ship tactics may be used to eliminate some actions or give added weight to others and thus, when combined with sensor errors and other uncertainties, this additional knowledge may lead to an improved targeting solution for long range anti-ship engagements for cruise missiles. A technique is sought which allows the addition of target ship tactics to the targeting solution.

N88-196 TITLE: Advanced Sensor Development

CATEGORY: Engineering Development

DESCRIPTION: Emerging technology may make it feasible to develop new sensors of specific interest to the U.S. Navy. Technological advances in the areas of special potential (SP), microconductivity, piezoelectric magnetometers and high resolution temperatures measurement techniques may permit new measurements and increased accuracies. Specifically, the applications for these sensors would include measurement of surface ice thickness from a submerged submarine. In addition to this, an ice profile display could also be achieved. The display would consist of a running contour of the lower and upper ice profile. The need exists for a device that can be mounted on Fleet Ballistic Missile (FBM) and attack class submarines that would accurately measure the thickness of ice and provide a running ice profile display in northern patrol areas. New sensors and improved accuracy of existing developments in the field of ocean temperature measurements and micro-conductivity would have wide application ranging from more accurate measurement of fluid flow across the launch area of FBM submarines to passive detection of internal waves generated by submarines.

N88-197 TITLE: Use Of Superconductivity For Signal And Power Distribution

CATEGORY: Exploratory Development

DESCRIPTION: The Navy is in need of improved electrical conductors which can carry low power high frequency signals as well as high power at low frequency. Although fiber optics serve well for signal transmissions they do not do likewise for power. Research is needed to develop superconductors for signal and power distribution which offer low weight and bulk since space and weight are critical. The specific intent is to develop the maximum superconductivity at the highest possible temperature while minimizing size and weight of the conductors.

N88-198 TITLE: Hermetic Packaging Equivalent

CATEGORY: Engineering Development

DESCRIPTION: Develop methods and standards to provide protection to integrated circuits (IC) equivalent to those provided by hermetic cavity enclosure (i.e., 38510 hermetic parts) without enclosing the IC in a cavity. Traditional packages are creating many problems as electronic systems shrink using new technology. Many alternatives known collectively as "Chip-On-Board" technologies have been suggested, but none have demonstrated the ability to withstand the combinations of hostile environments found by military systems. The work should start by addressing the question of relevance of current 38570 hermeticity tests to a part not in a sealed cavity. Beyond the environmental protection of the IC, manufacturability, and repairability should be addressed. New standards and test methods for non-cavity "packages" should be proposed.

N88-199 TITLE: GaAs Heterojunction Bipolar Technology Development

CATEGORY: Engineering Development

DESCRIPTION: Advanced strategic and space systems will require extremely high speed analog functions such as A/D converters for "smart weapons." GaAs heterojunction bipolar technology (HBT) offers the possibility of high speed combined with high precision. However, power requirements for this technology are rather high. A complementary HBT approach (combined NPN and PNP transistors in a monolithic chip) would help to substantially reduce power requirements without sacrificing performance. The goal of this development is to demonstrate the feasibility of manufacturing complementary GaAs HBT circuits through process development and characterization activities. Radiation hardening to strategic and space environments should also be a significant focus in the development.

N88-200 TITLE: Radiation Hardening

CATEGORY: Engineering Development

DESCRIPTION: Approaches are required for fabrication of power transistors which are hardened to neutron radiation. Novel ideas are needed for neutron radiation hardening of bipolar, DMOS or gallium arsenide power transistors for operation after exposure to neutron fluences of 3×10^{14} N/CM². This development program will define hardening approaches, develop manufacturing techniques, produce sample transistors, and perform radiation testing as proof of concept.

N88-201 TITLE: Thermoelectric Cooler Testing

CATEGORY: Engineering Development

DESCRIPTION: Current methods of determining the coefficient of performance and the delta temperature at maximum current of multistage thermoelectric coolers are slow and not well suited for large volume production. A quicker, easier method for large scale thermoelectric cooler testing is therefore needed.

N88-202 TITLE: Solid Rocket Motor Grain Design Program

CATEGORY: Advanced Development

DESCRIPTION: Design and develop a computer program for implementation on a VAX computer for the design of solid rocket motor grain configurations. The program should be interactive and addressable through terminal utilizing VT-100 protocol. The program should allow the motor design engineer to view and alter as necessary a three dimensional representation of the motor grain configuration. The program should simulate motor operation and provide the following outputs: (a) An image of the propellant grain during simulated motor operation including the ability to display (on the video or printed hard copies) selected views or expanded views of grain geometry details; (b) Tabulated data files of propellant burn surface area, motor free volume and propellant grain mass moments; and (c) Internal ballistic prediction of motor operation to provide motor thrust and pressure, pressure distributions within the motor as a function of time and grain burn back. The ballistics prediction module of the program should incorporate the effects of propellant properties, throat erosion, temperature, momentum effects due to grain geometry, and mass storage terms. The program should be written in Fortran in modular form to allow for future expansion/changes.

N88-203 TITLE: Ultra-Violet Cured Linear Systems For Rocket Motors

CATEGORY: Advanced Development

DESCRIPTION: Evaluate various liner systems that are readily applied in liquid form, which can then be quickly and reliably cured in place in rocket motor cases by the use of ultra-violet (UV) radiation. Such systems will be UV-curable in minutes, instead of the hours required for existing heat-cured systems. The UV cure should also be more reliable. The bond strength of potential UV-cured liners to the various substrates found in rocket motors will be optimized, as well as the hardware and techniques necessary to apply the liners in rocket motors on a pilot-plant scale.

N88-204 TITLE: A Portable Ion Accelerator For Real-Time Neutron Radiography

CATEGORY: Exploratory Development

DESCRIPTION: A requirement exists for developing a method of producing thermal neutrons using a portable ion accelerator with the following features: (a) Portable; (b) Thermal neutron flux sufficient to produce 30 frame/sec real-time neutron television images; and (c) Pulsed capability desirable.

N88-205 TITLE: Insensitive Munitions Protective Containers

CATEGORY: Advanced Development

DESCRIPTION: The purpose of this effort is to apply modern armor material technology to present container/launcher/canister, etc. designs to moderate or solve the fragment impact (FI) and sympathetic detonation (SD) problems of Navy munitions as defined in NAVSEAINST 8010.5. The goal is to reduce the probability of a detonation/explosion occurring in ships magazines due to fragments either from hostile or identified in considering approaches to developing an insensitive munitions (IM) container include: level of protection required, maximum fragment threat, maximum shock threat, thermal requirements, size, weight and cost constraints.

(a) **FRAGMENT IMPACT PROTECTION:** It is not necessary for the container to stop incoming fragments from impacting the munition. However, fragments perforating the container and impacting the warhead must have their velocity reduced to a much lower level. Currently, it is believed that fragment impact velocities below 6,000fps will not detonate the warhead. Expected fragments will have a real density approximately equivalent to .5 inch steel plate and masses approaching a half pound. Impacts should be assumed to be “flat” for the first design/model test iterations. For fragment/armor configurations producing impacts of the inner surface of the armor against the warhead skin, the impact velocity should be no more than the same 6,000fps for the first attempts.

(b) **SHOCK ABSORPTION CAPABILITY:** In the SD protection role, the container should, in addition to the level of FI protection described above, not exceed the tentative 6,000fps limit for inner surface impact with the warhead. The donor warhead for design purposes shall be considered a WDU-25/B Tomahawk Warhead, in a similar protective container. For this reason, the armor must be very securely attached to munitions, either via the container if it is sufficiently robust or independently.

(c) **TEMPERATURE CONSTRAINTS:** A protective feature will be required to function during a slow or fast cook-off. In slow cook-offs, the armor materials may not exceed 500° to 600° F at the time of reaction. In fast cook-off the armor materials may be experiencing 1200° to 1500° F or more on the exterior surfaces at the time of weapon reaction. The protection will be required until the energetic material of the warhead is consumed. This requires about ten minutes in fast cook-off after the explosive starts burning.

(d) **SIZE, WEIGHT, AND COST REQUIREMENTS:** The enhancements to the containers should be accomplished within the envelope of the existing container’s physical dimensions and should be accomplished at minimum weight and cost.

N88-206 TITLE: Embedded Laser Ignition Device For Rocket Motors

CATEGORY: Advanced Development

DESCRIPTION: Contemporary electromechanical arming-firing devices (AFD) for rocket motors have achieved a remarkable level of safety and reliability. The purpose of this program is to optimize elements of laser technology leading to development of a one-shot laser AFD that will equal the safety and reliability of current models while reducing cost, complexity, and size. A cost reduction of just 20% over current designs will save taxpayers literally millions of dollars per year in weapons procurement. Areas specifically needing investigation are maximization of energy outputs vs. size and minimization of laser energy required for ignition of rocket motor and propellant. Constraints of AFD size are 2.0 inches diameter and 4 inches in length. Probable energy source of the laser is zirconium wool but other schemes may be acceptable. The device must be capable of projecting a safety failure rate of less than 1 in 10⁹ and a reliability figure of 0.999 at 90% confidence level. Propellants to be ignited can be selected by the proposer but must meet the sensitivity requirements specified in the safety circular for fuze design, MIL-STD-1316C, paragraph 4.3.1. The system shall function after exposure to standard military environments such as five foot drop, temperature and humidity cycling, shock, shipboard and transportation vibration and extreme temperature storage.

N88-207 TITLE: Low Energy Flying Plate Detonator

CATEGORY: Advanced Development

DESCRIPTION: Current flying plate detonators require switching high voltage with short rise-times and large currents. Storage capacitors required to provide the necessary triggering energy exceed the space available in many applications and therefore occupy volume that should be applied to warhead explosive. The low energy technology is needed by the Navy to increase warhead size to its ultimate to maximize weapon effectiveness. Current efforts to lower the energy required to initiate flying plate detonators has been concentrated on alteration of approved secondary explosives which is forbidden by MIL-STD-1316C. The requirement for the detonator is an initiation energy of 50 millijoules required to initiate Hexanitrostilbene (HNS-4) or 350 millijoules for Hexanitrostilbene (HNS-1 or HNS-2). The low energy flying plate exploding bridge wire detonator is a component

needed to develop an aimable warhead in a small diameter missile. The total volume of the detonator, the associated transformer, firing capacitor and firing switch shall not exceed one cubic inch. The total volume must fit into a right circular cylinder that does not exceed 1.25 inches in diameter.

N88-208 TITLE: Desktop Transmission/Contrast Test Instrument For Near Infrared Polarizers

CATEGORY: Engineering Development

DESCRIPTION: Design and construct a portable desktop instrument capable of measuring transmission, contrast, extinction ratio, beam deviation and translation, angular acceptance (± 45 degrees), and power dissipation limits of transmitting near infrared polarizers. Consideration should be given to source and detector stability, transportability (light weight, low power), mechanical reproducibility and reduction of data via PC computer interfacing. Source calibration shall be NBS traceable in order to facilitate use as an industrial measurement standard.

N88-209 TITLE: Miniature Cryostatically Cooled Dewar

CATEGORY: Advanced Development

DESCRIPTION: Small infrared detector arrays require integrated Joule-Thomson cryostat cooling assemblies to provide cooling to the arrays and associated readout electronics to temperatures less than 80 Deg. K. and shall provide a stable temperature for a minimum of 10 min. with a 25 in³ gas supply at 5000 psi. The units shall meet all specifications while at an ambient temperature of -50 to $+75$ Deg. C. The detector array may be assumed to be composed of 15-30 pv HgCdTe detectors (0.002 to 0.004 in. diameter) with integral readout electronics consisting of preamplifiers, filters, and a multiplexer. The Detector unit shall be wither a vacuum dewar of an insulated assembly with external dimensions of approximately .5 x .5 in. Development of the cryostat, or cryostat & dewar package may be addressed. New approaches to achieve temperatures between 64 and 80 Deg. K. under the described conditions is an important design goal.

N88-210 TITLE: Programmable Actuator Load-Simulator

CATEGORY: Advanced Development

DESCRIPTION: Design and fabricate at a reasonable cost an actuator load-simulator capable of generating from -500 to $+2500$ in-lbs of torque and responding to a frequency input of at least 40 Hz. It should be programmable in the sense that varying flight time loads, both aiding and opposing, could be applied to the actuator. The load simulator can be electromechanical, hydraulic, pneumatic, etc. It should be operable both manually and via a computer, both digital and analog. Thus, it requires manual, digital and analog interfaces. The simulator will be used in laboratory environment, however it would be desirable for the simulator to operate over a temperature range of -40° F to $+145^{\circ}$ F.

N88-211 TITLE: Advanced Gun And Ammunition Concept

CATEGORY: Exploratory Development

DESCRIPTION: Develop an inherently accurate 20mm aircraft gun system of small size and inherently high firing rate capability. The gun would be a simple and reliable system requiring 25-50% fewer parts and provide equal reductions in system weight and size. Total system weight, including gun control unit, ammunition handling system and 500 rounds of ammunition would not exceed 680 pounds. Reductions in the length of the breech mechanism is of particular importance. A twin fixed-barrel (non-gatling type) gun system would provide at least a 4000 shot per minute firing rate. A twin barrel gun would reach 90% of full firing rate within 20 seconds and would fire at least fifty shots during the first 1.0 second operation. The accuracy and dispersion of the gun would be such that 880% of

the rounds fired would fall within a 6 inch diameter circle at 1000 inches. The centers of impact for the two barrels would be equal to their physical separation, plus or minus 2 inches at 1000 inches.

The ammunition cases would be manufactured from low cost and non-critical materials. The ammunition would provide dramatically improved insensitive munition characteristics. The ammunitions would be compatible with existing gun projectiles with minimum or no modification, although pre-engraved rotating bands are permissible if noteworthy performance improvements or prolonged barrel life can be substantiated. Muzzle velocities for a 20mm cartridge utilizing PGU-28 projectiles would be at least 3600 feet per second with 4000 feet per second or greater desirable. The cartridge would utilize percussion primers for initiation. The ammunition handling system would accommodate a total 500 rounds and would be of double ended, linear linkless design assuring positive kinematic control of ammunition under all operating conditions.

N88-212 TITLE: Thermoelastic Technique For Crack Growth Characterization

CATEGORY: Exploratory Development

DESCRIPTION: Thermoelastic techniques have been developed which allow the dynamic stress concentrations at crack tips to be quantitatively measured. These techniques rely upon the measurements of the adiabatic temperature rise which takes place when a material is under stress. Such temperature rises, which may be as small as thousandths of a degree Kelvin, occur synchronically with loading and thus can be separated from other effects such as viscoelastic heating. This technique should be developed for use with composite materials and other anisotropic materials in which the traditional experimental and analytical techniques for the study of fracture and fatigue are not applicable. It should be developed both as an NDT technique and as a technique for fundamental fracture and fatigue studies.

N88-213 TITLE: A Zoom Lens For Forward Looking Infrared Systems

CATEGORY: Advanced Development

DESCRIPTION: Current Forward Looking Infrared Systems (FLIR) used in military applications are required to be light in weight and have multiple different fields of view. Main disadvantages of using multiple fields of view is pilot disorientation of targets that sometimes exist when switching from one field of view to another. It is definitely noticeable when the targets are of low contrast and switching over a large focal range. The weight of existing optics represents a large percentage of the total system weight because germanium is almost twice as dense as BK-7 glass and the lens are generally fast in order to maintain high sensitivity. As a result, there is need for lightweight, compact and continuous viewing FLIR systems. Reducing the weight can be done by investigating new materials for the barrel and replacing three fields of view with a zoom lens. With a zoom lens, not only will continuous viewing be available, but the turret used to support multiple fields of view will be eliminated resulting in an additional decrease in weight.

The objective of this effort will be to develop a compact infrared zoom lens having a zoom range of at least 5 to 1. Since zoom lenses generally are longer than the equivalent long fixed focal length lenses, part of the feasibility study will be to see how to minimize its length by using latest design techniques. This study shall also include investigating lightweight optical materials as well as a cost analysis between fixed fields of view and zoom. If the feasibility study shows promising results, Phase II will work towards building a prototype zoom lens whose specifications will be determined by Phase II.

N88-214 TITLE: Use Of Geomagnetic Field Maps To Improve Magnetic ASW

CATEGORY: Exploratory Development

DESCRIPTION: Conventional Magnetic Anomaly Detection (MAD) techniques for ASW rely on detecting the magnetic signature of the submarine in the presence of the background geomagnetic field. A large quantity of

geomagnetic field survey data has been collected as part of the Navy's Oceanographic Survey Program. The objective of this effort is to determine whether the detection capability of magnetic ASW could be improved by utilizing digitized geomagnetic field map data to account for the geomagnetic field.

N88-215 TITLE: Acoustic Data Fusion

CATEGORY: Advanced Development

DESCRIPTION: Navy fire control and C³I systems are facing a data explosion due to new and improved sensor systems and communication channels. With respect to ship based contact management systems, this problem is exacerbated by the requirement to maintain an ever increasing area of coverage in order to counter threats posed by more powerful potentially hostile forces. A critical aspect of evolving fire control and C³I systems is the ability to fuse data from different sensor systems to generate scene descriptions which accurately depict the location of all surface targets in the region of interest, including friendly, neutral, and hostile ships. Over-the-horizon targeting requires knowledge about all targets in a region of interest in order to assess the probability of hitting the intended vs. unintended target. Innovative approaches to the use of attribute information in fire control and C³I systems, particularly in support of over-the-horizon targeting missions, are needed. The approaches should explore how attribute information may best be incorporated in the data fusion process, the techniques required to ensure the ability to handle a large volume of contact reports in a timely manner, and the possible use of artificial intelligence tools in ambiguity handling. A demonstration of the proposed approach on Navy supplied test data in a Navy supplied test bed environment should culminate the Phase I effort.

N88-216 TITLE: Rapid Data Base Search

CATEGORY: Advanced Development

DESCRIPTION: Design, develop, demonstrate and document a PC-based Proof-of-Concept (POC) Data Base Management System (DBMS) for the storage and retrieval of Acoustic Intelligence (ACINT) data now stored in voluminous ACINT publications. The POC system will use an interpreted version of a limited ACINT data base that will be supplied as Government Furnished Information (GFI) in the form of a DBASE III data base. The projected size of the data base will be 3500 records (350,000 bytes). Use of commercially available DBMS and graphics products is preferred. User access to the POC system will be through use of query form(s). Outputs of query matches will be rank ordered and presented graphically/textually to the user. Initial efforts will be to analyze the GFI data base and document the POC system design concept, rank ordering schemes, output screen layouts, and query screen layouts. Follow-on efforts will be to code, test, and document the PC-based POC DBMS system.

N88-217 TITLE: Low Frequency Acoustic Transponder

CATEGORY: Advanced Development

DESCRIPTION: The Navy has a requirement for low frequency acoustic transponders to perform acoustic calibrations at sea. Specifically, transponders are required to operate at frequencies below 1500 Hz with acoustic outputs in the order of 100 watts. Other prime considerations are wide bandwidth, wide range of operating depths, high electroacoustic efficiency and small size.

N88-218 TITLE: Processing Of Transient Signals

CATEGORY: Exploratory Development

DESCRIPTION: Many fundamental concepts and definitions in signal processing are based on steady state signals. These should be reviewed and revisited for application to non-recurring, generally broadband transient signals. Concepts include: theoretical models of the generation mechanism, optional array designs, recognition differentials,

and processing gains or losses. Surveys and theoretical analysis are appropriate. The Phase I effort should include innovative techniques to detect and classify acoustic transients. Techniques used in speech recognition, image enhancement, pattern recognition may be applicable. Transient sources include biological, environmental and man made noises.

N88-219 TITLE: Data Fusion

CATEGORY: Advanced Development

DESCRIPTION: The proposed new surface ship sonars with a low frequency active adjunct will cause an operator overload problem due to increased detection performance. A means of reducing operator overload therefore becomes a significant system issue. Data fusion, the integration of information from numerous sensor systems to eliminate a significant number of non-threat detections from contention, offers a means of achieving this goal. Studies are required to explore current efforts, and to define a sensor fusion hierarchy which might include data alignment, association, correlation, and situation assessment. The Phase I effort should also include the development of a data fusion architecture from alternative approaches and the implementation of a demonstration system should be promoted. The application of artificial intelligence techniques to the data fusion problem and identification of their limitations and strengths should be a part of this effort.

N88-220 TITLE: Submarine Mast Wake Reduction

CATEGORY: Exploratory Development

DESCRIPTION: Submarines are most vulnerable at periscope depth when one or more periscopes or masts pierce the surface. The key observables include the mast itself, radar reflections, infrared emissions, plume or rooster-tail, and the wake. The wake consists of a long, persistent scar on the surface which is easily observed, particularly by aircraft. Proposals are sought on methods for reducing and minimizing this wake. Possible methods may include modified mast and periscope fairing designs that cause less disturbance of water and treatment of the water to suppress or disperse the wake observables. Output of Phase I will be a design study and analyses detailing how to achieve wake reduction. Phase II would fabricate a prototype for a sea testing.

N88-221 TITLE: Submarine Warfare Fault Localization System Development

CATEGORY: Exploratory Development

DESCRIPTION: Current fleet submarine warfare systems. Including launcher, device and control subsystems, have low utilization frequency, yet high survivability/reliability requirements. A fault localization system capable of end to end system diagnostics is needed to ensure operability of system components. This fault localization system should be capable of assessing full system cable integrity and fault characterization. Launcher and control diagnostics would include pressure and switching validity checks. The objective of this work is to design and demonstrate fault localization techniques on a subsystem basis at the laboratory level in the initial phase. The latter phase would include prototype fabrication of an integrated fault localization system with automated sensing routines for use with the CSA MK2 system and ADC devices with installation check and routine operation modes. Emphasis in development should center on cabling and transducer subsystems fault localization, with switching control and launcher subsystems as second priority.

N88-222 TITLE: Array Telemetry

CATEGORY: Advanced Development

DESCRIPTION: The conceived multi-line towed arrays for use with the proposed low frequency active sonar systems will need near term dynamic range and overload recovery performance which exceeds that currently

available. At issue is the array telemetry which must linearly pass broadband signals with dynamic range in excess of 96 dB and in the event of an overload condition must recover in milliseconds. The array telemetry must also meet present performance specifications, size, power consumption and other towed array constraints. An investigation into conventional telemetry (hydrophone, preamplifier, analog/digital multiplexer) alternatives which might be feasible is warranted and if a suitable approach is identified, a prototype array should be constructed for demonstration purposes.

N88-223 TITLE: Contact Management Operator Interface

CATEGORY: Advanced Development

DESCRIPTION: Multiple Hypothesis (in particular multiple scene-level hypothesis) Contact Management Algorithms (MHCMA) are making breakthroughs as highly automated approachers to deal with high contact density environments. Their unique characteristic of carrying multiple scenes at all times presents unique operator interface problems for which innovative new approaches are needed. An operator interface approach for MHCMA should be developed to address operator scene presentation, operator interaction, operator hypothesis modification (and its impact on hypothesis scoring) and the resulting operator loading. This approach should be demonstrated on Navy furnished test data in a Navy supplied test bed environment as part of the Phase I effort.

N88-224 TITLE: Chemical Warfare Protective Coatings For Aviation Ground Support Systems

CATEGORY: Exploratory Development

DESCRIPTION: Sustaining combat effectiveness air operations on air capable ships and shore based sites depends on continued safe/effective use of aviation ground support equipments/systems. In the absence of a suitable protective barrier toxic agents can collect and be absorbed in the various support equipments, degrade their performance and then desorb over relatively long periods of time at great hazard to ground crew personnel. A need exists to develop and test novel materials to be used either as a paint additive final barrier coating for toxic agent protection of aviation ground support systems. Developed materials should both inhibit contaminant build-up and provide for rapid and effective decontamination.

N88-225 TITLE: Fiber Optic Network For Carrier Arresting Gear C³ Functions

CATEGORY: Advanced Development

DESCRIPTION: Existing shipboard arresting gear control systems were designed in the 1950's, employ relay logic, massive junction boxes and contain bundles of hand wire cables. They generally lack redundancy and are susceptible to battle damage. A control system update, currently in exploratory development, will be militarized with programmable controllers having standard and specialized electronic modules for regulation of arresting gear functions. Fiber optic systems, if applicable, can be networked for redundancy, are lightweight, do not emit electrical energy and are immune to electronic jamming and detection. The contractor shall examine the feasibility of applying fiber optic technology to the command, control and communications (C³) functions of Navy arresting gear. The Phase I efforts shall examine/define the requirements for interfacing fiber optic networks with electronic programmable controllers, select non-emitting pressure, temperature and position sensors, ascertain the feasibility of operating in a hot environment (up to 120° F compartment temperature and up to 200° F hydraulic fluid temperature) and accomplish trade-off studies leading to the definition of an optimal conceptual system or architecture for the implementation of all arresting gear C³ functions. The study shall also include, but not be limited to, assessments of performance, development risk, maintenance analysis, as well as the preparation of a development plan with key milestones, development costs and an estimate of life cycle costs.

N88-226 TITLE: Ultra Small Transponders For Missile Test And Evaluation

CATEGORY: Advanced Development

DESCRIPTION: In order to maximize their performance, new missiles are being built with very little room and no weight or power allowance for the transponders needed for the test and evaluation during the development phase for fleet training, and for follow-on lot sampling to ensure that the production missiles have not deteriorated in storage. Transponders currently used at test and training ranges are much too large for application to these modern weapons. Transponders are needed that are not only extremely small and light but are also extremely modular to allow them to “fit” in any available spaces and use what power may be available. Two transponders are of immediate importance: those used in the 141 MHz band and those at the 5500 to 5900 MHz precision tracking radar band. The Phase I effort should address the above requirements. Consideration should also be given to the design, fabrication and evaluation of prototypes.

N88-227 TITLE: Pulse Code Modulation Telemetry Transmitter

CATEGORY: Advanced Development

DESCRIPTION: The purpose of this task is to develop a telemetry transmitter which is optimized for use with pulse code modulation (digital) signals. Current telemetry transmitters were basically designed for use with analog signals. It may be possible to design a less expensive transmitter if one does not have to worry about preserving analog waveforms, etc. The digital telemetry transmitter would be required to be TEMPEST qualified. The transmitter must also be small and efficiently transform input DC power to output radio frequency power. The transmitter frequency bands are 1.435 to 1.535 GHz and 2.2 to 2.4 GHz. The transmitter output spurious responses, occupied bandwidth, etc., must be compatible with Inter-Range Instrumentation Group Standard 106-80. Each transmitter will be specified to operate at a fixed frequency in the bands listed above.

N88-228 TITLE: Battle Force Research Simulator Scenario Modularization

CATEGORY: Engineering Development

DESCRIPTION: Training scenario generation for Battle Force training currently requires many hours of labor-intensive development. Scenario developers require significant tactical systems experience to ensure the accuracy of scenario events and platforms actions/reactions. Some training systems possess limited prompts and menus to assist scenario developers. However, these capabilities only support the intended application of the individual training system. The result is a heavy reliance on Subject Matter Experts to verify Battle Force tactical training scenario prior to its actual use. The Battle Force Research Simulator (BFRS) will be operated by civilian scientists and engineers. A requirement exists to develop a means to automate scenario generation in a “user friendly” manner. Ideally, this capability would be modularized to permit non-subject matter experts to step through each phase of constructing complex Battle Force training scenarios. The resulting automated system should also interface with various tactical data bases to ensure the accuracy of platform parameters such as aircraft flight dynamics. This capability should include also a “universal translator” function to assist scenario developers in correlating diverse data bases and technology.

N88-229 TITLE: High Intensity Countermeasure Transducer

CATEGORY: Exploratory Development

DESCRIPTION: Increased range, speed, and sophistication of modern torpedoes have increased the difficulty of countering torpedoes. Torpedo countermeasure systems must be upgraded to maintain sufficient protection for submarines and surface ships. In general, higher intensity acoustic countermeasures permit more effective countermeasure systems. Present intensity levels of acoustic countermeasures are below intensity levels limited by cavitation. The Phase I effort should therefore be directed to developing transducer technology to maximize the

output intensity of acoustic countermeasures. Conduct in-water tests to demonstrate the high intensity capability of the transducer technology. Assume the size, operating depth, frequency range, and signal fidelity requirements of current torpedo countermeasures.

N88-230 TITLE: Compact Transducer Arrays For Underwater Acoustic Application

CATEGORY: Advanced Development

DESCRIPTION: This topic considers underwater acoustic projection technology with a frequency range of interest of 1 to 8 kHz with emphasis on the lowest octave. The objective of this effort is to analytically model and experimentally confirm the effects of various array configurations and sizes on the acoustic performance. Emphasis will be on the usable bandwidth and Q factor as well as the sound pressure levels produced. As an example, one might consider the development of a flexural disk transducer element and study the mutual radiation loading produced by multiple elements in an array configuration. Achieving high sound-pressure levels (SPLs) on the order of 200 dB re 1Mpa and low Qs less than (3) will make the effort a success. Typical size constraints dictate that the projector elements should be less than 6" in diameter. A typical array would reside, hopefully undeployed, in a 6" diameter by 18" length cylinder. The transducer technology chosen must exhibit reasonably high stability nominally over temperatures of 2 to 40 deg C and pressures of 0 to 900 psig.

N88-231 TITLE: Seawater Chemically Activated Battery

CATEGORY: Advanced Development

DESCRIPTION: A need exists to develop batteries that can withstand long periods of inactivation, up to 5 years of shelf life installed within a device, and transition to full operating output within 2 seconds. The requirements are for: (a) Seawater or chemically activated battery; (b) must be able to withstand adverse conditions; (c) small high density package for use in devices deployable from a submarine; (d) can operate at reduced levels over the operating life of the device; (e) transition to full power within 2 seconds after full power is required; and (f) be lightweight.

N88-232 TITLE: Solar Control System

CATEGORY: Advanced Development

DESCRIPTION: Solar systems are controlled by devices called differential temperature controllers which measure the difference between solar collector output temperature and storage tank temperature and determine whether conditions are appropriate to turn the pump on and initiate flow through the system. Research has pinpointed these controllers and sensors as likely problem areas. Recently there has been developed a fault detection system that works to spot these trouble areas as they develop, since the differential controller cannot do this. A need, therefore, exists for combining the electronics of both systems to have a unit that will both control the system and automatically detect any potential failures.

N88-233 TITLE: Polymer Impregnated Timber Waterfront Structures

CATEGORY: Advanced Development

DESCRIPTION: Navy waterfront structures of timber, steel, and reinforced concrete deteriorate rapidly due to service loading and attack by marine organisms. Further, Navy surface ships and submarines require deperming facilities for degaussing built-up magnetic fields. Degaussing requires a magnetic field-free structure which means deperming piers must be constructed completely of nonferrous materials. Current deperming facilities are constructed of concrete reinforced with an exotic stainless steel that is three times more expensive than ordinary steel and it is still subject to corrosion in a marine environment. An attractive alternative to steel and concrete construction is polymer impregnated timber (PIT) structures. Procedures for polymer impregnation of large wooden

structural elements are required and tests are needed to evaluate the material and structural properties of PIT. After evaluation of structural and material properties and the determination of life/cost characteristics, design guidance is required for engineering application of PIT.

N88-234 TITLE: Polymer Concrete Insulators

CATEGORY: Advanced Development

DESCRIPTION: Polymer concrete has been tested and found satisfactory for LF/VLF radio high-voltage applications. Tests have been made of the electrical and mechanical properties. Formulations have been optimized. Remaining work includes refining methods of fabrication of large insulators such as those used on tower bases. The proposed Phase I effort should focus on adapting methods currently used for conventional (Portland-Cement) concrete to fabrication polymer concrete insulators. The work should include the fabrication of sample insulators for testing and evaluation.

N88-235 TITLE: Remotely Piloted Vehicle Engine Design

CATEGORY: Exploratory Development

DESCRIPTION: The Navy has an interest in mini remotely piloted vehicles (RPV's) which can operate from sea-going vessels. All known engines of interest (25-35 HP) are gasoline powered. However, the low flash point and relative unavailability of gasoline on board ship preclude its use. This effort will investigate and identify an engine design which will produce 25 to 35 HP, operate on JP-5 and diesel fuel marine and weigh no more than 20 pounds. A major design consideration is the capability to start and operate at air and fuel temperatures of -40° F. The design study will identify physical and operational characteristics with emphasis on potential cruise and loiter specific fuel consumption (LB/HR/HP). The engine output power shaft shall be capable of accommodating a propeller mounting flange. Phase II of this effort will include the production and demonstration of a working prototype at standard day and cold (-40° F) conditions.

N88-236 TITLE: Low Cycle Fatigue Enhancement Of Blade Attachments

CATEGORY: Advanced Development

DESCRIPTION: Navy field studies have shown that disk blade attachments frequently suffer Low-Cycle Fatigue (LCF) cracking due to galling, machine marks and handling damage. Future engine design will require lower weight, more damage tolerance, higher load bearing capability and more LCF life than is now possible. These goals must be accomplished in the near term. Life enhancement techniques for non-circular stress concentrations are limited to surface treatments such as shot peening, roller burnishing and coining. These methods create relatively shallow zones of residual compressive stresses, are often sensitive to manufacturing variables and are dependent on operator proficiency. Better methods are needed to support future Navy engine design goals as stated above and in the proposed Engine Structural Integrity Program (ESIP). Such methods must be compatible with curved slotted surfaces as well as straight surfaces and should have the potential to reduce weight. The titanium alloys are of major interest.

N88-237 TITLE: Supersonic Combustion Flow Analysis

CATEGORY: Exploratory Development

DESCRIPTION: The next generation of Navy aircraft propulsion systems will differ significantly compared to current configurations. One area which affords great potential is supersonic combustion. However, there is insufficient analysis/data to assess the system payoff and/or limitations. Extensive 3-D analysis and experimental

verification is required to assess mixing/stirring in supersonic flow, shock propagation and stability and heat release rates. The program should include the investigation of reacting and non-reacting flows.

N88-238 TITLE: High Brightness Long Lifetime Ion Sources For Sources For Focused Ion Beams

CATEGORY: Advanced Development

DESCRIPTION: The most elegant use of submicrometer Focused Ion Beams (FIB) in semiconductor fabrication is the maskless and resistless ion doping for Very Large Scale Integration (VLSI). This application has the potential to reduce process-induced defect density, improve yield and reliability and lower cost of innovative, revolutionary device design based on the reproducible and uniform laterally-controlled doping for the realization of devices and circuits with unique and superior performance. This FIB capability, when applied to a 4- or 6-bit A/D converter circuits in Si, CMOS/SOS, eliminates the primary limitations of speed which occur in the resistor chain and multitude of comparators (16 or 64) and therefore provides performance approaching that of GaAs in resolution, signal bandwidth and radiation hardness. However, FIB is not without its own unique set of problems; the present current density for Liquid Metal Plasma (LMP) sources is limited to about 1 Amp/cm². For FIB to be viable in a production environment, the beam's current density must be increased by 1 to 2 orders of magnitude and source lifetimes increased from the present 10-100 hours (for dopant ions) to 500-1000 hours to achieve the current density improvement, the source brightness must be increased and the energy spread reduced. This will only be achieved through extensive research and development and a complete understanding of the source physics. Hence a requirement exists for the target current to be increased from 10-30 pA (beam diameter 50-100 nm) to 500 pA for all desired dopants. Therefore, long lifetime, high brightness LMP source with an increase of 10² to 10³ fold in current at the target and software-controlled programmability of dopant species (e.g., B, P, As, Si, Au,...) and energies should provide higher throughput (minutes versus weeks) allowing for implanting a 4-inch diameter wafer at the 10¹⁵ - 10¹⁴/cm² level. This effort is in support of the Navy "FIB" system development and the application of the FIB system to the design and fabrication of highly innovative, high performance electronic functions implemented in semiconductor substrates.

N88-239 TITLE: Shipboard Robotic Mobility

CATEGORY: Engineering Development

DESCRIPTION: One key problem barring the extensive use of robotic systems to reduce the manning requirements of ships is the incompatibility of conventional robotic mobility techniques with the shipboard environment of watertight doors, hatches, and step ladders, as well as deck motion associated with high sea states. This effort requires the investigation of approaches by which robotic systems can be provided some degree of mobility aboard ship, while ensuring that human passage is not obstructed. Consideration should be given to design changes suitable for installation in future ships, as well as mobility techniques that might be used on existing ships.

N88-240 TITLE: Improved Classification/Identification Techniques

CATEGORY: Advanced Development

DESCRIPTION: The ability to covertly perform surveillance and targeting of threat RF emitter provides a major operational capability and enhances the survivability of Naval resources. Successful implementation of passive RF surveillance and targeting systems requires improvement of classification and identification techniques. Signal characterization must be capable of measuring the dynamic nature of the electronic environment and changing signal characteristics on a pulse by pulse basis. Threat emissions are employing various countermeasure and low probability of intercept techniques, as well as war-mode operations to mask their signatures. These sophisticated covering techniques coupled with a dense signal environment require sensor systems that have a rapid throughput rate and the ability to uniquely characterize the emission in near real time. The development of processing approaches and techniques capable of achieving this level of performance should be compatible with existing sensor technology.

N88-241 TITLE: Tools For The Common Ada Programming Support Environment Interface Set

CATEGORY: Advanced Development

DESCRIPTION: The Common Ada Programming Support Environment (APSE) Interface Set (CAIS) has been developed jointly by the three services to promote the transportability and interoperability of Ada software tools. The approval of the CAIS as a DOD standard, DOD-STD-1838, on 9 October 1986 will certainly encourage its use. So far very few tools have been written for the CAIS that either employs the CAIS or assist the CAIS tool writer. The interest and application of this interface set is likely to increase dramatically in the near future. Thus, there is a need to initiate the development of a number of tools that will support this increased utilization of the CAIS. The functions to be performed by these tools are as follows:

(a) Performing Backups and Archiving: Proposed MIL-STD-CAIS and DOD-STD-1838 do not define interfaces that explicitly do back ups and archiving. However, tools that perform these functions may be written using the interfaces provided by the CAIS. These tools need to be developed;

(b) Transferring Tools and Their Data Across APSEs: There is the need for the development of interoperability tools for transferring CAIS tools and their data across APSEs;

(c) Performing Configuration Management: The CAIS provides a capability to support the development of a configuration management system. The feasibility of developing a configuration management system using CAIS needs to be verified.

(d) Providing a Capability for Executing DOD STD-1838 Tools on CAIS Version A: Compatibility packages that provide a capability for executing DOD-STD-1838 tools on CAIS Version A need to be developed. This need arises because of the inclusion of typing, expanded I/O, and other enhancements that are being incorporated into CAIS Version A. These packages would execute on CAIS Version A. Their use would eliminate the need to modify DOD-STD-1838 tools to allow execution on CAIS Version A.

(e) Assessing the Efficiency of a CAIS Tool: This analyzer would assess the efficiency of a CAIS tool by examining the CAIS packages, interfaces, and sequences of interfaces used. It would provide a quick way of determining what aspects of the CAIS are used and would suggest CAIS capabilities that are under-used or are not fully exploited.

(f) Measuring the Performance of CAIS Implementation: More and more implementations of the CAIS are being developed. There are no tools presently available for determining execution speeds, disk storage and memory used, and other performance characteristics. Soon this capability will be needed.

(g) Compilation System Built to DOD-STD-1838: Intermetrics Incorporated has developed a compilation system, including a compiler, linker, loader, program library, and pretty printer, for a subset of Proposed MIL-STD-CAIS. A compilation system needs to be built for DOD-STD-1838.

N88-242 TITLE: Transflective Liquid Crysta/Plastic Fiber Optic Modules

CATEGORY: Advanced Development

DESCRIPTION: The objective of this effort is to develop small computer driven display modules comprised of digitally addressed transflective (transmissive and reflected) liquid crystal light valves mounted on plastic fiber optic image expanders. The developed modules would be mosaic type building blocks which could be used to build larger displays for either group or single user applications by modifying the illumination technique. These building block liquid crystal/plastic fiber optic modules, that would be amenable to mass production and the associated economies, could become the basis for building low cost, high resolution, flat panel displays for tactical applications.

N88-243 TITLE: Anti-Submarine Warfare Display

CATEGORY: Advanced Development

DESCRIPTION: Current sonar time-bearing displays show a significant detection performance degradation (compared to theoretical) attributed to their normalization processing. Innovative normalization techniques are needed to achieve improved detection performance in the short term through simple software modifications to

existing systems. The Phase I effort should include the demonstration of concepts on Navy supplied real and simulated test cases and in Navy supplied test bed environment.

N88-244 TITLE: Improve Electronic Support Measures Sensor Capabilities

CATEGORY: Advanced Development

DESCRIPTION: Present shipboard automated broadband Electronic Support Measures (ESM) systems have multi-target, automatic detection and display capabilities with fixed or variable signal comparison software. These systems function in Anti-Ship Missile Defense (ASMD) alertment roles. Because of the environmental signal density and the reduced time elements required by automated systems for self defense, threshold sensitivity has been reduced to prevent system and operator environmental overloading. True threat alertment (indications and warnings) relies on single specific signal detection and classification at extended ranges. This can be a single operator function when run in parallel with an automatic system without degrading the value of the automatic system because the Indications (I) and Warning (W) and ASMD roles are mutually supportive non-conflicting sensor functions. However, a parallel display system will be required. Those few ships presently equipped with both automatic and manual systems periodically suffer from bearing discrepancies between the two systems. The Phase I effort should be directed at developing a prototype single specific conjunction with present automatic systems which will utilize existing antenna systems and can be adapted to all ships with automated ESM systems.

N88-245 TITLE: Microwave Absorbing Paint

CATEGORY: Exploratory Development

DESCRIPTION: A requirement exists for the formulation and demonstration of a paint-like broadband microwave absorbing material suitable for application to metal surfaces to reduce interfering reflections (ghosting) in S, C, X, and K bands.

N88-246 TITLE: Prediction Of Flow Around Ship Hulls

CATEGORY: Advanced Development

DESCRIPTION: A requirement exists for developing computer software or for applying existing software and demonstrating its capability to predict flow about three-dimensional bodies such as ship hulls. Techniques utilizing solution of the Navier-Stokes equations are required to address complex flows such as that about the stern region of ships. Novel approaches are required so that the computer code is capable of adequately representing arbitrary three-dimensional shapes and provide meaningful solutions within practical computation times and storage limitations. The prediction of the turbulent, incompressible flow about an airfoil/flat plate juncture will be required to demonstrate capability of the computer code.

N88-247 TITLE: Oxygen Pressurization

CATEGORY: Exploratory Development

DESCRIPTION: Develop methods to pressurize oxygen gas to 3000 PSI on board Navy surface vessels. The quantity of oxygen to be pressurized is 10-15 lb/Hr available at or near atmospheric pressure. Innovative approaches to pressurize the gas safely are invited, including processes which first liquefy the gas. Safe and reliable operation are paramount requirements.

N88-248 TITLE: Mathematical Model For Predicting Helicopter Gearbox Failure Modes

CATEGORY: Advanced Development

DESCRIPTION: A mathematical model is needed which will define the most likely failure to be encountered in modern helicopter gearboxes. This will be used in developing a detection system utilizing various forms of vibration analysis for discovering defective bearings and gears within helicopter gearboxes. Determining the most likely failure will require a statistical evaluation of gear and bearing failures from available engineering information on overhauled helicopter gearboxes. The historical failure data should be partitioned into component (e.g., gears, bearings, seals, free-wheeling units), failure mode (e.g., spalls, corrosion, cracks, lubrication depletion), gearbox (e.g., main transmission, intermediate gearbox, tail rotor gearbox), aircraft, component time (if possible) and any other classification that is appropriate. Although Navy helicopters are of primary interest, suitable information on other helicopters would be of value.

N88-249 TITLE: Advancement of Built-In-Test Concepts

CATEGORY: Advanced Development

DESCRIPTION: Experience with the Built-In-Test (BIT) of equipment in service has shown that the BIT performance falls considerably short of the specifications for fault detection isolation and false alarms. As system complexity increases and new state of the art equipment is introduced, such as fault tolerant computers, the BIT designs must evolve with the designs and their performance must become better than those in current use. There is, therefore, a requirement for studies to identify and evaluate state of the art BIT concepts and recommend those applicable to aircraft systems. Emphasis should be placed on advancements to improve detection, fault isolation, false alarms, and display.

N88-250 TITLE: Predication Model For Helicopter Gearbox Life Expectancy

CATEGORY: Advanced Development

DESCRIPTION: The effectiveness of a helicopter gearbox defect detection system is dependent upon the warning that is given prior to the complete failure of the gearbox. Techniques are under development for detection of gearbox component defects. These efforts mainly address the identification of the size of defects that can be detected. There is a great need to be able to relate the size of the defect that can be detected to the amount of warning time (expected duration of acceptable operating time) that remains before the gearbox can no longer transmit the required operating power. A requirement exists to develop a model to predict the life expectancy of a helicopter gearbox given a known type and size of bearing or gear defect. It is anticipated that this research might start with rate of growth of specific sizes and types of defects under various loading conditions. These loading conditions may be related to the expected operating life. For this study, restricting the effort to the most likely defects on a single representative rolling element bearing and a single representative gear would be acceptable.